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ENGINEERS AS PRINCIPALS IN LARGE UNDERTAKINGS.

Favorable action on the recent proposal, noted elsewhere, of Messrs. Sprague and Crosby to equip and operate vast extensions to the New York city subway system, as routed by them, will be highly gratifying to all branches of the engineering profession, as a recognition of the capabilities of engineers to take a leading part in an enterprise the design, construction and operation of which are largely matters of engineering. In the present case it is solely a question of supplying transportation to meet a pressing need; the return on the property will be entirely dependent upon the engineering skill, technical and executive, exercised in its construction and equipment, and in operation the highest commercial skill would not avail to add a single fare to the income. Apparently the newspapers consider it somewhat novel for engineers to come forward as principals in a great undertaking like the present one, thereby reflecting a prejudice that no longer has any real grounds. An organization built up and directed by engineers is now constructing the Philippine railroad system at a cost greatly exceeding that required for the proposed New York subways; and in the past ten years a number of organizations essentially engineering in their personnel have grown up that financially control and direct the operation of electric light and traction syndicates, each representing investments of the order of millions. We are not informed of the engineering interests behind the proposal of Messrs. Sprague and Crosby, but almost any of these organizations would be amply able to secure the capital necessary to carry out the proposed undertaking, and their engineering departments could, with obvious expansions, take charge at once of all details of the work. Of one thing the public would be assured, if engineering interests instead of Wall Street financiers were to predominate in the design and operation of the new subways—the final capital charges would actually correspond to the outlay, and matters affecting the convenience of the public would, as they arose, be considered with relation to all operating factors and not be dependent upon the personal mood or the cupidity of a magnate trained in a school which regards the public merely as grist for the financial mill.

It is fitting that the name of Frank J. Sprague should be associated with a proposition of the character of the present one, involving as it does the highest interests of engineering. For more than a quarter of a century he has been one of the active factors in the great industrial development of that period. Taking hold of the electric motor when it was of little more than academic interest, he freed it of the incubus of the so-called "Jacobi's law" and in a few years forced its introduction throughout the world. Similarly, he later took the electric railway, then represented by a few crude trial roads, and in a few years placed electric traction, both at home and abroad, on a definitive commercial basis, well earning for himself the name of "Father of the Electric Railway." Foreseeing that

electric traction had a future beyond the single-car unit, he next devised the multiple-unit system of control, which approximates the control of a train of electric cars to the control of a single unit. And when the first great step in the electrification of steam railroads was to be taken Sprague was naturally selected as a member of the commission to lay down the lines the work should follow. In all of this brilliant career three points of character have stood out strongly which, in an enterprise like that here considered, would stand the public in good stead—scrupulous honesty, persistency of purpose and an independence of "interests" that at times verges on the aggressive.

CANADIAN ELECTRICAL RECIPROCITY.

It is certainly a very interesting coincidence that just at the time when Canada and this country are trying to enter into closer and more friendly trade relationship an evidence of hearty good will toward America should have been given by the Canadian Electrical Association in its acceptance of a proposal to affiliate with the National Electric Light Association. The idea or plan originated wholly within the Dominion and is an exhibition of largeness of view and breadth of sentiment upon which our Canadian brethren are to be congratulated. The incident is probably unique in international engineering affairs, but the absolute identity of principles and practice in the industry as pursued on both sides of the border makes it easy to carry out an affiliation for which a large common membership is already the base. Nor is it less a happy coincidence that Canada should thus join hands electrically with us at a time when our own body has a Canadian for president and an Englishman for secretary—both to-day "good Americans" in every sense of the phrase.

For some time past the National Electric Light Association has been developing successfully its plan of geographic or State sections, and only within the last week or so Mississippi has voted to fall in line. This movement gathers strength as it goes, but obviously the Canadian union is of somewhat different character, as the constitution of our society makes no provision for such an international getting together. The N. E. L. A. has, however, shown a wise spirit in doing all that is possible to build up its geographic sections, and it will now be just as anxious to help make the Canadian Electrical Association bigger and stronger and more useful than ever, enjoying as it grows the fullest measure of autonomy. It seems not unlikely that the Canadian action will do much to stimulate the desire in our other State associations to become affiliated, for such an example of willingness to co-operate and such a belief in the doctrine that the greatest good will come from united effort must carry conviction with it.

The National Electric Light Association has, indeed, done much of late years to deserve the esteem and confidence of the electrical public, and its marvelous growth in membership has been accompanied by an equal growth in influence. The federation of the two bodies is a further guarantee that the National Electric Light Association will not be controlled by narrow views nor fall into the hands of cliques or selfish groups. Such dangers always beset large societies and cannot be watched against too vigilantly. If they had not been inspired by high ideals before, the leaders of the association would now assuredly feel called upon to justify by its work and usefulness the splendid confidence thus shown in them by their central-station colleagues in Canada. We cannot but felicitate both societies. The recent expansion of the activities of the National Electric Light Association has given it a place in the international electrical field which is now only comparable with the corresponding one occupied by the German Electrical "Verband," an account in detail of which appears elsewhere in this issue. While, however, the expansion of our body has thus far been confined almost entirely to the limits of the central-station industry, the German society has gradually absorbed every electrical activity which usually finds a manifestation in a society organization.

CENTRAL-STATION DATA.

Many interesting data have been contributed to the general fund of central-station information by the Commonwealth Edison Company of Chicago the past few years. In some particulars this company has been in a position to get exact information on important subjects which is difficult for most other central-station companies to obtain through their own experience. In a recent talk by Mr. E. W. Lloyd before the Chicago Electric Club some interesting facts were given in connection with the growth of central-station business in Chicago. One of the striking statements made was that the maximum yearly load had been more than multiplied by ten in a period of ten years. This is partly due to taking on a large electric railroad load, which is not common to other central stations, but is nevertheless instructive as showing what a company with sufficient foresight in its management can accomplish in the way of supplying the power needs of a great community. The statement that ice manufacture from central-station steam-generated power is to be begun the next season in Chicago is of considerable interest, as ice manufacture has heretofore been mostly confined to steam-driven ice plants using the exhaust steam as distilled water. However, if cheap enough, electric power from a great steam-turbine plant, or from a water-power, can be profitably employed in making ice from "raw" undistilled water by means of any of the systems whereby water during freezing is kept in agitation to prevent the freezing in of bubbles and impurities.

Another interesting figure given by Mr. Lloyd is that only 70,000 out of a total of 125,000 customers are household customers. In smaller cities and towns, as is well known, the proportion of household or residence customers is much greater under a management relatively as progressive as that displayed in Chicago. This simply illustrates the typical fact that our largest cities represent the most undeveloped fields for residence business. The Chicago company is now earning $4.50 gross annually per capita of population on lamp and motor business alone, exclusive of its railway load. This represents a most notable increase the past few years, and it is the more notable because, as has just been intimated, it has apparently been harder to bring the gross earnings per capita up to a high figure in larger cities than in the small cities and towns. Earnings of $6 to $8 per capita are found much more frequently than formerly, but usually among cities of less than 150,000 population.

Mr. Lloyd's statement that a form of contract giving a lower rate to off-peak business is to go into effect in Chicago is of considerable interest, because, although many smaller companies have tried the plan, it has been considered a specially

difficult matter to enforce such contracts in large cities. The method of determining the customer's compliance with the off-peak clause in this case is to be by the use of a printing attachment on the watt-hour meter, which will record at regular intervals the watt-hours consumed, so that a record of the month is readily obtainable hour by hour. Mr. Lloyd gave as the ratio of the maximum load to the connected load of the system the factor of 2.5 to date, exclusive of railway business. This represents a total system demand factor of 40 per cent, which is lower than in days of old and will doubtless become still lower as the percentage of residence business increases.

IMPROVEMENTS IN FLAMING ARCS.

A recent report of Professor Marchant, Liverpool University, on developments in electric lighting indicates that the flame arc, which is considerably used for street lighting in England, has been undergoing steady improvement, so that at the present time the efficiencies reached are even higher than was the case in the practice of a year or two ago. As our readers will remember, London has been a sort of out-of-door laboratory for trying new illuminants for several years, and the competition between gas and electricity has been sufficiently keen there to insure the latest types of illuminants being kept in use. Street lighting is to a considerable extent a battle between "press gas" and flame arcs, in which the latter are fully holding up their side of the conflict. Professor Marchant has been testing a number of recent arcs in the sphere photometer and the results prove to be of no little interest. One familiar type of vertical-electrode lamp showed a specific consumption of a scant 0.27 watt per mean lower hemispherical candle-power on a consumption of as little as 280 watts. In other words, here was a 280-watt street lamp giving over 1000 actual lower hemispherical candle-power. A little more powerful type of the same arc consuming not quite 400 watts showed a specific consumption of but 0.17 watt per mean lower hemispherical candle-power. Considering that this type of arc gives its maximum candle-power about 25 deg. below the horizontal, and that this is more than double the hemispherical candle-power, its useful application to street lighting in face of any kind of competition is sufficiently obvious.

These figures show plainly enough that there has been steady improvement in the electrodes for this type of arc and that the results now attainable are materially better than those which have been reported in previous seasons. Of course, the difficulty of frequent trimming still remains and the cost of the electrodes is relatively high. Our present tariff bill, with its punishment of all the varieties of electrodes which anyone ever desires to import, of course, acts to check the introduction of flame lamps, although some excellent work has been done toward providing the material in this country. Whether the American central-station manager will eventually take kindly to more frequent trimming remains to be seen, but the indications are that he would do so if the cost of the electrodes themselves was less serious. The mere matter of trimming every day is not of itself forbidding, albeit it is undoubtedly rather a nuisance. It is worth noting that the two forms first mentioned here were both trimmed with so-called white-flame electrodes, which can accordingly be pushed to an efficiency altogether better than was at first believed to be possible save with the yellow electrodes. From an esthetic standpoint the advantage of the white electrode is perhaps a material one, and it certainly is of importance if the white flame can be obtained as is here shown with a really high efficiency. Flame arcs such as those tested by Professor Marchant seem a very effective answer to any question raised by the advocates of press gas, and we shall hope to see some of them thoroughly tried out in this country, both as an example of what is being done by our friends across the water and as a stimulus to the art in general.

THE HEUSLER ALLOYS.

About eight years ago it was discovered by Heusler that certain alloys of copper, manganese and aluminum—substances which are non-magnetic in the pure state—are powerfully ferromagnetic. It is believed that the magnetic properties of the alloys circle around the manganese component as center, because the aluminum may be substituted with a certain degree of success, and the copper appears to play the part of a diluent, which at the same time helps to make the alloy malleable. The highest magnetic flux density yet produced in such alloys in low magnetizing fields appears to be about 11 kilogausses, or about equal to that obtainable in cast iron. An interesting research on Heusler alloys has recently been published by Mr. A. A. Knowlton in *The Physical Review*. It appears that when microphotographs are made of samples of these alloys they reveal white crystals embedded in the mass. According to the conclusions obtained from the research, the magnetic capabilities of the sample depend upon the proportion of these crystals to the total mass; so that not only could the magnetic behavior of a sample be predicted from an examination of its microphotograph, but also the magnetic intensities developed were found to be practically in proportion to the ratio of the surface occupied by white crystals to the total surface of the microphotograph.

On the other hand, the actual magnetic condition of the sample did not always correspond with the crystalline areas, apparently for the reason that the proper temperature treatment adapted to each sample had to be used in order to elicit its latent magnetic properties. That is, the extent of the crystalline areas betokened the capacity for magnetization, under the proper temperature conditions, and not the actually existing magnetic state. Where no crystals could be found no thermal treatment was effective in developing magnetic properties. The sudden changes in magnetic condition following changes in temperature appear to be associated with corresponding discontinuities in electric resistivity, but neither with any perceptible change in microphotographic structure nor with any perceptible change in internal heat energy. Consequently, the changes occurring within the white crystals from the magnetic to the non-magnetic condition must be delicate or recondite changes, as distinguished from profound and easily detected changes. It is interesting to remember that the substance of ordinary soft magnetic iron contains, under the microscope, numerous crystals and shows an essentially crystalline structure. This suggests that the crystalline state of molecular aggregation is associated in some way with the magnetic properties of a substance. In other words, the observations on the Heusler alloys suggest that the magnetic properties of a substance may not be molecular, but may pertain to certain symmetrical structures of the molecules of the substance. A single molecule might not be magnetic, although the group might be.

Proposal for Independent New York Subway.

Messrs. Frank J. Sprague and Oscar T. Crosby, as representatives of certain independent financial and engineering interests, have submitted to the Public Service Commission of New York City a proposal for the equipment and operation of an independent subway system, the cost of which as estimated would not exceed $75,000,000. The proposal outlines the routes of the subway, which in its details differs from the present subway in the rearrangement of stations, including the abolition of reservoir platforms and transition tracks; reduced dimensions, but ample to accommodate the standard size of urban car, with suitable track ballasting; abolition of walls between tracks on the same level, and independent forced ventilation so that the limits of practicable schedule may not be impaired by the imposition of excess duty on train equipment.

Upon construction the lease of the road is to be on an indeterminate franchise basis to an independent operating compay having an authorized stock and bond capital of $40,000,000. The proposition of Messrs. Sprague and Crosby is for the equipment and operation of the subway, which is to be built by the city according to the plans drawn by the engineers of the Public Service Commission in consultation with the engineers of the operating company, the plans to have joint approval.

Proposed German Patent Legislation.

Complaint has been made by some German manufacturers against the United States patent agreement of 1909, which is stated to have established a condition of affairs very unjust and highly detrimental to the interests of German patentees. By this agreement American owners of German patents are entirely relieved from the obligation to work their German patents either in Germany or the United States, whereas Germans are still obliged to work their patents in Germany.

With a view to removing this unjust discrimination and placing Germans at least on an equal footing with Americans in regard to the maintenance of their patent rights in their own country, it is now proposed to amend or alter the German Patents act. To that end the Imperial Chancellor has recently submitted to the governments of the various German federal states a draft of an act relating to working obligations in regard to patents.

The act provides that if the patentee, even on being offered an adequate remuneration of security, refuses to grant another person the permission to use the invention, the patent can be revoked or the right to use the invention adjudged to the other person, if the granting of such permission is found advisable in the public interest (compulsory license). Such right can be granted with restrictions and made dependent on conditions. Moreover, so far as international conventions do not interfere, the patent can be revoked if the invention is being exclusively or chiefly worked outside the German Empire or the colonies, but no decision can be rendered against the patentee before the lapse of three years from the publication of the granting of the patent.

When a motion asking for revocation of a patent on account of refusal to grant a license has been filed, the decision entertaining such motion must be preceded by a warning to the effect that revocation will ensue, at the same time stating the reasons and fixing an adequate time limit.

Under the proposed act, as it now reads, a patent cannot be revoked as heretofore for failure to work the invention in Germany, but it can be revoked—or the patentee's right thereto restricted by a compulsory license—if the patentee refuses to grant others the right to use the invention for an adequate remuneration or security offered by them, provided, however, that the granting of such permission be found advisable in the public interest.

Central-Station Investigation in St. Louis.

The investigation into the affairs of the Union Electric Light & Power Company, of St. Louis, made by the Public Service Commission of that city, reached an interesting stage on Jan. 24, when the company filed a formal statement with the commission. In this statement it is said that the cash cost of the property and business last spring was $23,411,867. For a long period of years the company failed to earn any return upon its investment, and assuming that 8 per cent was a fair return the deficit amounts to $5,739,369. Therefore, the company argues, the total investment in the company's property and business, represented by the cash put into the property and the amount which the investor has failed to receive back in the earlier years, is more than $29,000,000.

As to rates, it is said that the average rate charged by the Union company for electric service is lower than the rates prevailing in Boston, Brooklyn, New York or Chicago, and about the same as the average rate in Baltimore.

For the purpose of estimating the amount of money it would take to reproduce the existing property in business the company has retained the firm of Ford, Bacon & Davis, and they report that such cost would be about $26,000,000, without taking into account the deficit from early operation. The company asks the right simply to earn a return on its actual investment. To support its contentions it has called as witnesses Mr. C. F. Uebelacker and Mr. William Von Phul, of Ford, Bacon & Davis, and Prof. M. E. Cooley, dean of the engineering department of the University of Michigan.

President Alten S. Miller, of the Union Electric Light & Power Company, has made a report to the stockholders in which he says that the increase in gross revenue during the year 1910 was 9.3 per cent. The increase is due entirely to the increased sale of energy, since the average rate per unit sold has decreased 2 per cent below the corresponding rate for the preceding year. During the year there was an increase in operating expenses, including $29,000 for the St. Louis Public Service Commission investigation and $6,000 for the government income tax. However, the net profits were somewhat in excess of the net profits of 1909. Gross income in 1910 was $3,371,520 and net earnings $780,968. Six per cent is paid on $9,885,000 capital stock.

In conclusion Mr. Miller addressed his stockholders in relation to the public service investigation as follows: "We believe that it is immeasurably to the interest of this company and its stockholders and bondholders that the commission and the company's consumers, and the public of this city as well, be afforded the fullest and clearest information as to its service, properties and every other element affecting its business. Publicity with regard to all these matters will be of benefit to the company and to the public. This policy in its widest possible application has been adhered to throughout the inquiry."

On Jan. 25 Mr. Carroll Miller, of Providence, R. I., brother of the president of the Union Company, was a witness before the commission to show the value of development work in public-utility operations. The commission will make its report to the Municipal Assembly at the conclusion of the hearing.

Terminal Electrification at Boston.

The Joint Commission on Metropolitan Improvements, consisting of the Massachusetts Railroad, Harbor & Land, Metropolitan Park and Boston Transit Commissions, has submitted a report to the Legislature upon the electrification of steam railroads in the Boston district. The report declares by a vote of nine to seven that it is inexpedient to require the railroads to electrify their Boston lines at the present time on account of the great cost of the work and the absence of a so-called standard system of electrification. The board feels that the wisest course is to enact no legislation whatever, but to let the problem work itself out without interference by the

State. It contends that only twelve or fifteen miles radius could be electrified for the estimated cost of $40,000,000 on account of the large number of radial lines feeding the suburban districts. The board states that there seems no reason to suppose that economies would be found that would make electrification profitable to the companies for a considerable time to come. Judging from the experience in New York, the commission states, it would entail a loss in excess of the interest on the new capital required and it would be necessary to raise the suburban fares in order to furnish the required revenue. The board feels that electrification is a luxury and that if the State Legislatures begin to enact laws compelling the expenditure of large sums for a luxury there is serious danger that the roads will find it difficult to raise the money they need even for necessary improvements. In New York the only requirement has been the discontinuance of the use of the steam locomotive south of the Harlem River on account of the danger of tunnel operation. In Boston the projects for a tunnel connecting the North and South stations and a tunnel under Boston Harbor, if carried out, will necessitate electrical operation which will have to be extended to convenient points beyond the tunnel at each end. This will lead to gradual and not forced extension of the system. Even in this case some increase in revenue may have to be obtained by the roads, but there will be other economies due to the tunnel which will partially offset the cost of electrification.

The minority of the joint board includes the majority of the Massachusetts Railroad Commission and two members of the Boston Transit Commission, who dissent from the conclusion that the cost of electrification is too great to justify legislation requiring the railroads to prosecute it at present. In the opinion of the portion of the joint board which possesses the preponderance of expert transportation knowledge experience elsewhere has demonstrated both the feasibility and the financial ability of railroad corporations to equip a portion of their lines with electricity, and these members find no conditions in Boston or its vicinity which lead them to a different conclusion. They point out that the officers of the New York, New Haven & Hartford Railroad have stated publicly on several occasions their purpose, if allowed to control the Boston & Maine system, which control is now effected, to equip both systems with electricity for a considerable distance near Boston, and they also emphasize that the further proposals of the New Haven management to electrify the Revere Beach road if acquired are evidence that electrification to some extent is both feasible and within the financial ability of both companies. The studies submitted to the joint board by the Boston & Albany Railroad also indicate feasibility within a cost far from prohibitive. The minority states that it is convinced that the public welfare demands some legislation with respect to electrification, and that while it is not in favor of compelling the electrification of all steam railroads of standard gage within the Boston district before a date now to be fixed, the minority does not believe that leaving the matter in the hands of the several railroad companies exclusively will result in as speedy action as will follow some legislative requirement indicating the policy of the State. The whole question is now thrown upon the Legislature, and in view of the growth of public sentiment in the last two years in favor of electrification it is certain that there will be an active discussion of the subject before the close of the present session.

New York Companies' Section of the N. E. L. A.

The New York Companies' Section of the National Electric Light Association was fully organized at a meeting held on Tuesday, Jan. 24, in the Twenty-seventh Street auditorium of the New York Edison Company. This section, which includes all the lighting companies of Greater New York, with the exception of the Brooklyn Edison Company, which has its own separate section, bids fair to be one of the most successful in the association, having already a membership of 500. The officers of the section were unanimously elected as follows: Mr. Arthur Williams, the New York Edison Company, chairman; Mr. J. F. Becker, the United Electric Light & Power Company, vice-chairman; Mr. E. S. Bellow, Westchester Lighting Company, treasurer; Mr. Jesse Richards, New York & Queens Electric Light & Power Company, executive secretary; Mr. F. C. Henderschott, the New York Edison Company, recording secretary.

The executive committee consists of the following: Messrs. F. W. Smith, United Electric Light & Power Company; H. M. Edwards, the New York Edison Company; C. G. M. Thomas, New York & Queens Electric Light & Power Company; J. T. Cowling, Westchester Lighting Company; H. E. McGowan, Flatbush Gas Company; J. E. Phillips, Richmond Light & Railroad Company; J. M. Butler, the Bronx Gas & Electric Company; Carleton Macy, Queens Borough Gas & Electric Company; Stuart Wilder, Northern Westchester Lighting Company; I. M. Beatty, Peekskill Lighting & Railroad Company; J. P. Radcliff, Jr., Yonkers Electric Light & Power Company.

Rumored Telephone Combination.

Prominent Ohio Independent telephone men say they have no knowledge of any plan to consolidate all the telephone properties between New York and Denver into one giant corporation, as was reported from St. Louis, New York and other places last week. It was said that J. P. Morgan & Company had sent out a tentative proposition for the consideration of the big Independent companies at St. Louis, Kansas City, Joplin and other places, and that the officers and directors would probably look with favor upon the offer which would put their properties into about the same position as those of the United States, Cuyahoga, Columbus Citizens', Toledo Home and Dayton Home telephone companies.

The Ohio men state that plans have been completed to do away with the dual system in that State through the absorption of the Bell exchanges in the towns and small cities by the Independent companies, and that in all probability only two or three of the largest local exchanges will be retained by the Morgan interests. In that way they believe that eventually there will be but one local company in each county, except where a county has several large towns, each of which may have a company.

In most cases the stock of the local companies will be held by local people and managed by them. The claim is made that companies owned by local men have proved a success, while the Bell exchanges, under the ownership and management of a company owning a large number of properties, have made small returns on the investment and have proved unsatisfactory in other ways. It is for this reason that the Bell interests are willing to dispose of the properties at figures favorable to the Independents.

The idea, the Independents say, is to take the lead in doing away with the dual system of telephones, under the new conditions that have arisen, and other states are expected to follow the lead. If possible, a law will be secured that will allow the merging of local companies, under proper conditions, with the business under the supervision of a public-utilities or special commission. Some of the other states have no laws preventing such mergers, and action will not have to be taken in them. But where this is necessary it is the plan of some of the Ohio men to set an example that may be safely followed by both the companies and the people, as they propose to play a fair game, with everything made public, in the future.

J. P. Morgan & Company, it is said, are in accord with all that is being done along this line and are willing to abide by the terms of the proposed law, which will require the conduct of the business to be in strict accord with fairness to the people who patronize the companies. The modern view of the operation of public utilities is to be observed and everything will be open and aboveboard, if the Legislature adopts the ideas that will be presented to it.

Telephone Rate Investigation in Chicago.

The hearings before the City Council committee on gas, oil and electric light in relation to the question of revising telephone rates in Chicago resulted in a disagreement. Alderman Pringle, chairman of the committee, says that the committee has found as the result of its investigations that the Chicago Telephone Company has a surplus of $216,000, and the committee believes that existing telephone rates should be decreased to an equivalent of that amount. Mr. W. J. Hagenah, the expert retained by the city, has been instructed to prepare a reduced-rate schedule, which will be taken up at a meeting of the committee to be held about Feb. 7.

On behalf of the company President B. E. Sunny is emphatic in saying that the company will not accept reduced rates unless it is compelled to do so by the courts. Mr. Sunny is quoted as saying: "There is not a chance of our company adopting reduced rates. We are operating on an absolute minimum margin and any reduction would nearly ruin the company."

A long statement has been issued by the company, reciting the contentions already given in the accounts of the investigation printed in this journal, with some other arguments. It is pointed out that Mr. Hagenah's figures as to the value of the company's property in Chicago are $4,600,000 less than the company's estimate. After an allowance of 8 per cent for dividends on the value so reduced and 5½ per cent for depreciation, the Council committee puts the surplus for the year 1909 at the $216,000 referred to. If this amount is wiped out by reducing rates during the next five-year period, the company says it will close each year without a dollar in its treasury in excess of the cost of operation, interest on capital stock and depreciation.

Further, the company contends that no allowance is made for the expense to which it will be put to remove its underground cables to make way for the proposed passenger subway in Chicago, for the installation of meters at customers' stations, or for any increase in the payroll of the company. Again, the company contends strenuously that the city has refused to allow it to purchase the telephone property of the Illinois Tunnel Company and that, therefore, it is about to be subject to competition. The company points out that if its rates are to be regulated by competition it is an unusual and unheard-of thing that they should likewise be regulated by the municipality. Municipal regulation necessarily means the exclusive right to conduct that class of service. The company does not ask for a general increase in rates, but it argues that some classes of service which it is now furnishing at a loss, and which are discriminatory, should, together with other needless items of expense, be abolished.

Competing Automatic Telephone Service in Chicago.

The speaker at the meeting of the Electric Club of Chicago on Jan. 18 was Mr. H. D. Critchfield, of the Automatic Electric Company, who gave an interesting account of the automatic telephone exchange system now in process of construction in Chicago for competition with the manual service of the Chicago Telephone Company. He said that the Chicago Telephone Company operates 240,000 telephones in Chicago as the result of thirty-three years of business life. This represents 100,000 lines of central-office equipment connected to about thirty exchanges. The present rehabilitation of the automatic telephone service by the Subway Telephone Construction Company for the receivers of the Illinois Tunnel Company began on May 6, 1910, and there are now more than 37,000 prospective subscribers who have signed contracts for the automatic service, each taking an individual line. Comparing these individual subscribers' lines with those of the older company, it will be seen that the competing company has more than one-third as many. The automatic company has established eight exchanges—four in the central Loop district, two on the South Side, one on the West Side and one on the North Side. The exchanges in the Loop district have a capacity for 24,500 lines and the four outside exchanges have an initial capacity of 5000 lines each and an ultimate capacity of 10,000 lines each.

In the rehabilitation of the automatic service twenty-seven miles of trench have been built, exclusive of the sixty-two miles of tunnels underlying the central business district and used for the cables of the automatic service. In the trenches 118 miles of conduit has been installed. The automatic company must have 20,000 bona fide subscribers by June 1 of this year, but according to present indications that number of subscribers will be connected up by April 1. The number of automatic telephones actually connected on Jan. 18 was 3900 and installations were being made at the rate of 260 a day—a rate which will be greatly increased.

The automatic service will not be limited to the 20,000 subscribers required by the contract with the city, but a general competing telephone service will be given at a rate of $50 a year for residence telephones and $85 a year for business houses, unlimited individual-line service being given in each case.

Mr. Critchfield said that the existing manual service is as efficient as it is possible to give under the conditions encountered in that service. He contended, however, that it is impossible to give as efficient service, or service rendered at as low a cost, by the manual system as by the automatic system. He pointed out the difference in payrolls for one thing. The annual payroll of the Chicago Telephone Company, he said, is $1,528,000. To give the same service under similar conditions the automatic exchange would need a payroll of but $375,000 a year. This includes actual operating expenses, but no overhead charges. The difference between these two sums is equivalent to almost 6 per cent on the total appraised valuation of the Chicago Telephone Company.

Considering efficiency of service, the speaker said that an automatic telephone connection is made in about six seconds and the length of time required does not increase as the number of subscribers increases. On an average the manual system requires twice as much time. This means 4000 hours of subscribers' time wasted daily in Chicago, and this time is computed to be worth $720,000 a year.

By the automatic system there is no interruption during conversation, and there is an instantaneous release on the conclusion of the call. There seems to be a feeling in the telephone field, said Mr. Critchfield, that no one has a right to do business but the original people, nevertheless, the 37,000 contracts secured for the Illinois Tunnel Company show that the public wants more telephone service than it now has. There is room for the newer telephone business. Complaint is often made of the telephone operator, but the fault is not hers once in ten times. The operator is usually doing the best she can with what she has to do with; the fault is with the manual apparatus, wonderful as it is. The telephone service is very important to business interests, and with two telephones, connected to two distinct systems, the chance of total interruption of telephone service is almost negligible.

It was denied by the speaker that the automatic apparatus runs down quickly owing to wear and tear. He cited the example of the Grand Rapids (Mich.) automatic exchange to prove this. Under a seven-year guarantee in Grand Rapids the manufacturing company was called upon to replace parts in the automatic exchange valued at only $962.34 in a system that grew from 4500 to more than 11,000 telephones in the seven-year period. The depreciation on the automatic system is much less than than on any manual system. The first cost of equipment for automatic service is about one-third less than for corresponding manual service. In the items of conduit, cables and trenching the original cost is conspicuously less. Mr. Critchfield also mentioned the examples of the Fall River (Mass.) and San Francisco exchanges to prove the success of the automatic telephone system. There was no discussion.

Chicago Automobile Show.

At the Chicago Automobile Show, opened on Jan. 28 at the Coliseum and First Regiment Armory, and to last a week, nearly all the makers of electric pleasure vehicles are represented. The interiors of both the Coliseum and the Armory are handsomely decorated, the former in Louis XV style and the latter as a formal English garden. Both arc and incandescent lamps are used for lighting, and with tall illuminated columns, artistic lamp standards and bowls of foliage plants, with light showing through apertures in the vases, the effect is very pleasing.

The list of exhibitors of electric carriages is as follows: Anderson Electric Car Company, Detroit; Babcock Electric Carriage Company, Buffalo; Baker Motor Vehicle Company, Cleveland; Broc Electric Vehicle Company, Cleveland; Hupp-Yeats Electric Car Company, Detroit; Ohio Electric Car Company, Toledo; Rauch & Lang Carriage Company, Cleveland; Studebaker Brothers Manufacturing Company, South Bend, Ind.; Waverley Company, Indianapolis; Woods Motor Vehicle Company, Chicago. The vehicles shown are rich and attractive, but as they are smaller than the gasoline machines and usually, but not always, finished in somber black, they are less conspicuous than their more showy neighbors.

A large variety of automobile accessories are shown in the galleries of the two buildings. Those of electrical interest are displayed by the following named exhibitors: Adams & Westlake Company, Chicago, ignition lighting system; Connecticut Telephone & Electric Company, Meriden, Conn., magnetos, steering-wheel switches, etc.; Electric Storage Battery Company, Philadelphia, Exide batteries; James L. Gibney & Brother, Philadelphia, electric vulcanizer for tire repairs; Heinze Electric Company, Lowell, Mass., magnetos, spark plugs, etc.; Kokomo Electric Company, Kokomo, Ind., ignition specialties; K-W Ignition Company, Cleveland, "high-tension" magneto; Lutz-Lockwood Manufacturing Company, Aldene, N. J., ignition dry cell; National Carbon Company, Cleveland, ignition dry battery; Pittsfield Spark Coil Company, Dalton, Mass., spark coils; Simms Magneto Company, New York, magnetos, spark plugs; C. F. Splitdorf, New York, magnetos, spark plugs; Standard Welding Company, Cleveland, electrically welded parts; United States Light & Heating Company, New York, vehicle and ignition batteries; Vesta Accumulator Company, Chicago, batteries, magnetos, lighting specialties; Warner Instrument Company, Beloit, Wis., auto-meter (speed indicator based on magnetic pull of annular permanent magnet).

Following the exhibition of pleasure cars there will be a week's showing of commercial motor vehicles at the Coliseum, Chicago, from Feb. 6 to 11, inclusive. In this show, also, there will be a number of electrical exhibits.

The Design of Electric Heating Appliances.

Mr. Charles P. Madsen, engineer for the Pelouze Electric Heater Company, Chicago, gave an instructive talk before the Lewis Institute Branch (Chicago) of the American Institute of Electrical Engineers, Jan. 25, on the subject of "Electric Heating Development."

After referring to the erroneous conceptions regarding "carrying capacity" and the significance of mere resistor material which the electric heating engineer is likely to carry with him from other fields of apparatus design, Mr. Madsen declared that the real problems in heating-appliance construction are the choice of current-carrying material of proper stable physical characteristics and the use of insulation able to withstand high temperatures unaffected. Practical resistor materials used commercially are of three classes: (1) *Loose compositions,* in which the resistance is due to loose contacts between integral particles. Cryptol, a special crystallized carbon, carborundum and pure silicon are examples of this class. Such heating elements secure high temperatures, but are cumbersome and have a large factor of variation, presenting an initially high resistance when cold, which lowers, admitting more current, as the element warms. Such elements, therefore, heat comparatively slowly. The particles are also consumed with use, changing the resistance characteristics of the element in time. (2) *Chemical precipitates,* such as the gold-chloride coating given an insulating surface, in the case of certain foreign apparatus. Here the thin deposit forms the resistance element. (3) *Metal wires,* including the newer special alloys. The low resistance of pure copper makes it bulky to use as resistor metal, while it has the further disadvantages of melting at 2200 deg., oxidizing at 1800 deg., and tending to sublime or evaporate above 500 deg. German silver, despite its high resistivity, has certain physical objections. Nickel-copper and nickel-chromium alloys, appearing under many trade names, have proven extremely successful. Nickel-steel, on the other hand, has been a sore disappointment, said Mr. Madsen. A nickel-chromium compound offered on the market contains additions of manganese and iron. An important advantage of nickel-chromium is that it is not chemically affected at high temperatures, a slight film of oxide being produced which protects it effectively. Being black in color, the oxide assists in radiating the heat. Copper-nickel compounds are useful for developing large quantities of low-temperature heat. For temperature below 300 deg. Mr. Madsen recommended copper-nickel; above this, nickel-chromium alloy. Iron is affected at high temperatures, but is useful in certain applications.

Mr. Madsen looked forward to important developments and improvements in satisfactory insulating material for heating-appliance work. At present lava, porcelain and mica are successfully used, although all of these are slightly affected in high-temperature service. Mica, besides its occurrence in small pieces in nature, has given trouble from hidden metallic salts between its laminæ, which when heated are reduced to metallic form, causing short-circuits of live parts. Built-up mica blocks may have the binding lacquer evaporated out after use, allowing the mica chips to fall apart. Although generally understood to be useful as high-temperature insulators, asbestos, glass and water glass are worthless, since they become conducting after being heated.

Heat energy is transmitted away from the element in which it is produced by three methods: conduction, radiation and convection. Embedded-wire construction employs conduction; open-wire, conduction and radiation; and the suspension-type, radiation and convection. In a toaster of the last-named type, exhibited by Mr. Madsen, the heating elements, reaching a temperature of 1000 deg., have the ¼ in. expansion in their 4-in. lengths compensated by mica springs. A reflector below the heating element redirects all downward radiation upward onto the utensil bottom, securing an efficiency of 82 per cent for this device, contrasted with the usual efficiencies of 20 per cent to 50 per cent of average iron-top disk-stoves. The speaker also exhibited a copper-top disk stove in which advantage is taken of the thermal conductivity of copper to convey heat as rapidly as it is transferred across the points of contact (even if few in number) with the irregular utensil, following the principle of the soldering tip. This stove displayed an efficiency of 68 per cent. Heretofore the softness and tendency of copper to warp prevented its use for disk-stove tops, but the top shown, although comparatively thin, was braced rigidly by a bridge construction beneath the heating element. In closing, Mr. Madsen discussed the manner of carrying on the design of heating appliances and spoke of the "factor of lag" in embedded-wire construction, which may allow the actual temperature of the wire, accompanied by its resistance, to rise, diminishing the current taken below the value corresponding to the desired temperature as given in the wire manufacturer's tables.

Street-Railway Service in Chicago.

Choosing as his subject "Transportation in Chicago," Mr. L. H. Davidson, assistant secretary of the Board of Supervising Engineers, Chicago Traction, addressed the Electric Club of

Chicago briefly at the weekly luncheon Dec. 14. Mr. Davidson gave an account of the very marked improvement in street-railway conditions in Chicago within the last three years as the result of the adoption of the "traction settlement" ordinances and their enforcement under the direction of the Board of Supervising Engineers. He told of the interest excited in other cities, and, indeed, in other countries, by the working out of the unique plan adopted in Chicago.

About 1,020,000 passengers are handled daily in and out of the downtown district in Chicago by the transportation companies of the city. Something over one-half of this number are transported by the surface railways, the elevated and steam suburban railroads taking the remainder. The street-railway equipment has been improved in every way since the rehabilitation was begun under the ordinances, and whereas the general purchasing power of a dollar has steadily decreased in the last few years, the purchasing power of the carfare nickel has as surely increased. To-day a street-railway passenger in Chicago gets a longer and more comfortable ride than ever before. The service is more frequent, and the cars are modern, well lighted, well heated and well ventilated.

To bring about these improvements large amounts of money have been expended. On Dec. 1, 1910, the grand total of the capital account of the surface railway companies, excluding the Consolidated Traction Company, was about $111,000,000, nearly equally divided between the original valuation allowed when the 1907 ordinances were adopted and the amount that has gone into actual tangible improvements since that time. The investment includes about 765 miles of track and 3000 cars, of which 2200 are of the large, double-truck type. There are thirteen substations for the distribution of electric energy, with a combined rating of about 100,000 kw, as well as twenty-six car houses.

Under the supervision of the Board of Supervising Engineers the rehabilitation has included the reconstruction of 415 miles of trolley wire, 1150 miles of cable, 200 miles of conduit in streets, 1200 duct-miles in conduits and nearly 3000 manholes.

The reconstruction work is rapidly nearing completion. The Van Buren Street tunnel under the Chicago River is now in operation, and tracks are being laid in the Washington Street tunnel, while work is progressing rapidly on the La Salle Street tunnel. The last named will consist of a double-steel tube sunk in the bed of the river. The work of relocating elevated railway columns to permit new curves for through routes in the downtown district is proceeding rapidly.

Besides accomplishing these results, the traction ordinances provide for the payment of 55 per cent of the net receipts from operation to the city, and from this source the city has received nearly $5,000,000 up to date.

In the discussion Mr. Ralph H. Rice, assistant division engineer of the Board of Supervising Engineers, pointed out that something over 7,500,000 lb. of copper has been placed in overhead trolley wires and underground feeders and auxiliaries as a result of the rehabilitation process. All purchases have been made under standard specifications.

Mr. T. Milton, of the Electric Storage Battery Company, described briefly the storage battery at the Plymouth Place substation. This battery was installed to carry the morning and evening peak. The railway company pays a fixed amount for its maintenance, and the battery shows a net saving on the investment. It carries a load of about 5000 amp during the morning and evening rush hours.

Mr. George P. Nichols commented on the improved service in Chicago, and also remarked that the companies evince an honest desire to remedy defects when complaints are made to them.

Mr. William Artingstall, one of the engineers of the Board of Supervising Engineers, described briefly the manner of constructing the steel-tube tunnel at La Salle Street. This tunnel consists of a steel shell 278 ft. long and about 24 ft. in diameter from top to bottom. It is a double bore, and each section is lined with reinforced concrete. The structure will be floated into place and sunk when the approaches are ready. In its work in the river at this place the Board of Supervising Engineers has erected the deepest cofferdam ever constructed, with the highest reinforced-concrete retaining walls for the approaches. In the Van Buren Street tunnel the grades in the approaches are as high as 11.5 per cent, but in the La Salle Street tunnel there will be no grade higher than 10 per cent.

President F. P. Vose and Mr. Davidson praised the work of the Chicago mounted police in regulating street-railway and other traffic in the central downtown district. Messrs. D. W. Roper and F. J. Postel also spoke briefly.

Regulation of Telegraph and Telephone Companies in New York.

A section of the annual report for 1910 of the New York Public Service Commission, Second Distict, relates to the division of telegraphs and telephones. By an amendment of the law which became effective on Sept. 1, 1910, the powers of the commission were enlarged so as to include corporations furnishing these services.

In the case of telephone corporations operating within the State and engaged in interstate business the statute places a part of them under the jurisdiction and supervision of the commission and exempts a part. The report says it is a matter of embarrassment and much to be regretted that the statute provides no means of determining whether a telephone corporation is under the supervision of the commission, and especially in the case of those corporations which are exempted by reason of the fact that they do not have property actually used in the public service within the State of a value exceeding $10,000. The commission points out that it has no power to examine and appraise the property of a corporation not within its jurisdiction for the purpose of determining whether it has jurisdiction over the corporation and its property, but declares that if it had such power it is questionable whether it would be practically effective, owing to the very large number of such corporations operating within the State which at least claim that they have not property exceeding $10,000 in value. This would make the task of appraisal an exceedingly long, expensive and laborious process.

To handle the additional work imposed by this additional jurisdiction a separate division of telegraphs and telephones was established, with a chief of the division in charge and a corps of assistants and inspectors.

In compliance with an order schedules have been filed by a large number of the telephone corporations. The report adds: "It appears from these schedules that in the past the corporations have put themselves in the position of charging one person more than they charge another for substantially the same rates. In the case of the New York Telephone Company alone, out of a total of over 337,000 subscribers, some 31,000 are being served under old contracts at obsolete rates, involving a difference of more than $284,000. Other companies show similar percentages of discriminatory rates, and only a few have reported no obsolete rates in effect at all.

"The public service commissions law clearly recognizes in various provisions that discrimination is not always unjust and should not always be made unlawful. It is only unjust and unfair discrimination which is condemned by that statute. When full examination and consideration have been given to the subject, if any of the existing discriminations are found to be just they can be allowed to stand. As to such as are unjust it will be the duty of the commission to issue an appropriate order requiring all such rates hereafter to conform to the standard schedules filed by the corporations. This will undoubtedly have the effect of raising the rate paid by a considerable number of persons throughout the State. It is to be anticipated that the persons affected thereby will consider that they have a vested right to the lower and discriminatory rate which they have been heretofore enjoying, and will feel that the effect of the public service commissions law and of the action of the commission thereunder has been to raise all rates. It is to be anticipated that the corporations affected may through

their employees give assurance that the raise in rates which is occasioned by such order is chargeable solely to the commission and to the working of the public service commissions law.

"The commission, however, deems that it has a clear duty to perform in this respect and should not be deterred therefrom by fear of any criticism arising from persons who have heretofore enjoyed the benefit of favor or discrimination."

Now that all public service corporations using poles and wires within the streets and highways are under the supervision of the commission the report says that an important line of action may be undertaken by the commission relative to the many fatal accidents which occur, including among the victims both the employees of the corporations and the traveling public. At the same time due consideration may be given the question of the numerous and unsightly poles and fixtures which occupy the streets of many of the municipalities. After a proper study of these matters, rules and regulations may be framed which will be calculated to improve existing conditions.

The commission has directed the division of statistics and accounts to prepare a form of annual reports and a uniform system of accounts for telephone corporations.

Attention is called to the fact that the use of telephones in train dispatching is supplanting the Morse telegraph system on a number of lines. On some roads a portable telephone equipment is carried on passenger trains.

Mid-Year Meeting of the American Electric Railway Association.

The American Electric Railway Association held its annual mid-year meeting in the Engineering Societies Building, New York, on Jan. 25, 26, 27 and 28. The activity of the association during the meeting was confined to the holding of conferences by the numerous committees to which the work of the association is delegated.

On Wednesday, Jan. 25, meetings were held of the committee on standard classification of accounts, the executive committee of the Claim Agents' Association, the committee on schedules and time-tables, the committee on transfers and transfer information, the committee on block signaling for electric railways and the interurban rules committee. Each committee selected subjects for discussion at the next convention.

At a meeting of the joint shop accounting committee of the Accountants' and Engineering Associations, held on Thursday, a sub-committee was appointed to report on what constitutes maintenance, in order to distinguish between ordinary replacements and those that constitute a proper addition to capital account. The committee as a whole decided to make a study of efficiency and incentive systems in the shops, such as premiums, piece work and bonuses. Definite recommendations will be offered for consideration at the next meeting of the entire committee, which will probably be held next May.

The executive committee of the Manufacturers' Association at a stated meeting held on Thursday appointed a special committee consisting of President Charles C. Castle, Secretary George Keegan and four others to select the time and place of the next convention.

The executive committee of the Accountants' Association held a meeting on Thursday. It was announced that the association will have five committee reports at the next meeting instead of three as heretofore and that there will be two joint sessions with other affiliated associations instead of one, as was the case last year. The two new committees are the one on car-miles and car-hours and the joint committee with the Transportation & Traffic Association.

On Thursday and Friday the executive committee of the Transportation & Traffic Association held meetings at which were discussed the budget for the ensuing year, interurban rules, block signals, transfers, express and freight traffic, schedules, city rules, new members, training of employees and passenger traffic. It was decided that at the next convention no individual outside papers will be presented, but the time will be devoted to the presentation and discussion of committee reports. The chairman of each committee will arrange to have at least two persons not connected with the committee present oral or written discussion on the committee's report, each discussion being limited to ten minutes.

On Saturday the committee on equipment of the American Electric Railway Engineering Association held a meeting to select the subjects for discussion at the next convention. The subjects will include the method of heating cars; design of car body, trucks, motors and equipment parts, having in mind reduction in weight without the sacrifice of strength; unit-basis comparison of weights; coupler report of the Central Electric Railway Association, including signal, air and control connections as proposed for general standardization.

On the evening of Jan. 27 the American Electric Railway Manufacturers' Association gave a banquet at the Hotel Astor to the American Electric Railway Association, which was attended by about 500 people. The toastmaster was Mr. C. C. Castle, president of the American Electric Railway Manufacturers' Association. The speakers were: Mr. Arthur W. Brady, presiden of the American Electric Railway Association, who spoke on "The Association"; Hon. William B. McKinley, United States Congressman and president of the Illinois Traction System, on "The Public and Public Utilities"; Col. H. G. Prout, vice-president and general manager of the Union Switch & Signal Company, on "The Manufacturer," and Mr. Patrick Calhoun, president of the United Railroads of San Francisco, on "Intelligent Popular Government and Public Utilities." In his speech Congressman McKinley expressed the conviction that the relations between the railways and the public would be greatly improved by the company impressing the trainmen with the value of politeness. He said that the book of rules of the Illinois Traction System has on its cover the sentence, "Be civil and you will comply with the greatest rule of all." The speaker said that there need be no antagonism between the public and the operators of traction properties. Mr. Calhoun remarked that the prime requisite for good government is good administrators, so that the public-service corporations can be left to conduct their business in a manner most useful to the people and without being subjected to blackmail or other political jobbery. The greatest political crime is to attempt to bribe an entire community by imbuing the people with the idea that they should take away the property of the public-utilities corporations which are trying faithfully to serve them.

Proposed Modification of System of Accounts in New York.

A hearing on an order modifying the uniform system of accounts for electric corporations was held on Jan. 9 by the New York Public Service Commission of the First District. Commissioner Milo R. Maltbie presided.

Mr. H. M. Edwards, auditor of the New York Edison Company, who was the first witness, testified that he had considered the order made by the commission to take effect on Jan. 1, 1911, in regard to the distribution of subway rental. The order required that the expenditures for subway rental be excluded from operating expenses and be treated as an income deduction. Operating expenses included the cost of production, distribution and supply of electrical energy, including the cost of billing calculations, general expenses, taxes, bad debts and depreciation; the total was to be the entire cost of conducting the business. The division of this total by the quantity of energy generated or sold gave the unit cost per kw-hour. Income deductions were intended to cover the cost of the capital invested in the business and such other costs as were not directly incident to production and sale of energy.

If the order of the commission was not abrogated or

changed, Mr. Edwards said the result would be to eliminate from the operating expenses for the year 1910 about $1,079,375 of subway rental expense, almost 11 per cent of the total, thereby reducing the apparent unit cost per kw-hour sold from 3.76 cents to 3.35 cents. This would destroy the value of the comparison with previous years and would withhold this very important factor when the management was considering the effect of extensions and of costs generally, because statements of costs as promulgated included the cost of operation only and did not include a statement of income deductions. The company rented subway ducts from two companies, the Empire City Subway Company, Ltd., and the Consolidated Telegraph & Electrical Subway Company. If the company owned its own subways it was probable that the cost of construction would be represented by its bonds, loans, capital stock or the investment of its surplus earnings, and the amount now represented by subway rentals would be divided into the various operating expense accounts and the interest on the cost would be treated as an income deduction. But as the company did not own its subways the conditions of the business in the boroughs of Manhattan and the Bronx were not uniform with the conditions existing elsewhere in the State. The subway companies' cost for investment included all the ducts built, of which the New York Edison Company rented only a portion. It was also a fact that only 46 per cent of the ducts built, as shown by the reports of the subway companies, were under rental. It would be impossible for the New York Edison Company to conjecture what the corresponding investment was for the ducts which it occupied. The amount of ducts which the company had under rental fluctuated constantly. It was free to abandon any duct if it could save subway rental by concentrating its cables in one duct. The subway companies' investment was as a whole and it did not follow that they would be able to show figures of cost for different sizes of ducts.

Mr. Edwards added that the subway rental situation was brought about by act of the Legislature. The amount which the company should pay for the occupancy of the ducts was approved by municipal authority. The rental was charged at a unit cost per mile of duct per annum as rented and occupied and, therefore, the expenditure could be looked upon properly only as an operating expense. The action of the commission did not produce uniformity of accounts with other companies, which charged expenditures in connection with subway ducts to operating expense.

Mr. John W. Lieb, Jr., third vice-president of the New York Edison Company, testified that the uniform system of accounts was intended to provide, among other things, a comparison between the respective costs of different lighting companies so as to permit judgment of the relative efficiency with which they are conducted. By far the largest item of cost in the operating expense accounts under the heading "transmission" was "subway rentals." To leave out this item, which was nearly 50 per cent of the total cost of "transmission," would take from this cost one of the important links of the steps in the series of operating costs proceeding from production at the generating station to the delivery of the product to the consumer and would so modify the cost of transmission that it would no longer appear in its proper relation to the other elements of operating expense. Companies that did not use a high-tension generating station with a transmission system to substations usually had higher cost of production owing to their unfavorable location. The cost of production was lowered considerably by the selection of a waterside site for production favorably located for coal, water, etc., but distant from the area of energy consumption. This difference was offset in part, however, by a new element of operating expense thereby introduced, the transmission to a substation, of which subway rental was a main item. To remove this cost from the operating accounts eliminated the comparison of operating costs between different companies as heretofore in effect, so far as it was at all practicable, and destroyed one of the values of the uniform system.

Moreover, Mr. Lieb said, where a company did not have a drawing-in subway system, but operated underground, it provided an equivalent in the shape of a covering or armoring and protection to the cable, and the cost of maintaining this, which was the equivalent of a duct, would appear in that case as an operating expense. The duct for which subway rental was paid was a similar protection.

Unless there was some very weighty reason for change, it would be unfortunate to modify the basis upon which all of the accounts had been kept for many years past and all of the different elements of cost entering into the total cost of production had been computed. It would be very unfortunate to have two sets of figures of operating costs, one for use by the company and another on a different basis for use in reports made to the commission.

Mr. Frank W. Smith, secretary of the United Electric Light & Power Company, testified briefly.

Mr. R. A. Carter, vice-president of the Consolidated Gas Company, said that the principal objection to the enforcement of the order was one that was apparently made in relation to the payment of other rentals. The order directed that the rental of offices in buildings, for example, should be included in the operating expenses. It seemed to Mr. Carter that the same reasoning applied to subway rental. Furthermore, the elimination on any theory from operating expenses of an item that was an absolute and legitimate operating expense seemed objectionable, whether for the company's purpose or for the public statements. It was misleading because it created what were known commercially as fictitious net earnings. While there might be included at present in the item of subway rental as shown in the operating expenses some items of return on property which would throw a company using that system out of comparison with any other company, the elimination of the entire item would have identically the same result.

Mr. A. F. Weber, chief statistician of the commission, called attention to the fact that expenses were divided into operating expenses, taxes, etc., and that "rent deductions" were classified among the income deductions.

Mr. Carter held that taxes, rentals for subways, etc., were expenses of the business.

Mr. L. E. Stander, accountant of the Public Service Commission, testified that the gross revenues of the Consolidated Telegraph & Electrical Subway Company for 1909 were $1,112,329. Operating expenses were $143,827, taxes $95,425, and uncollectible bills $1,531, leaving $871,546 applicable as income. The report of the subway company stated that the New York Edison Company had the right to vote a majority of its stock. The New York Edison Company owned $63,600 of common stock of the subway company and the Morton Trust Company, as trustee for the New York Edison Company, held $1,516,000.

Mr. Weber said that the principle upon which the commission's accounting orders had been promulgated was that expenses were divided between what might be called the prime cost of production and the return upon the investment. Wherever possible a division was sought between those two elements of rent. If the companies desired to include in their operating expenses a part of the rents, they should place their contracts on a basis whereby the total operating expenses would be distributed among the different companies participating. The rent would then comprise a portion representing cost, which was properly included in operating expense, and the remainder would go to income deductions, which included the return upon the investment.

Mr. John A. Garver, of counsel for the United Electric Light & Power Company, said that every item of rent included a return upon capital.

Commissioner Maltbie said that the system of accounts represented the attempts of the commission to secure a separation of operating expenses from what the State imposed in the form of taxes and from a return upon capital.

The hearing in the matter was closed.

Proposed Telephone Commission in Ohio.

A bill to place the telephone companies of Ohio under the supervision of a public-utilities commission has been framed by Independent telephone men and within a short time will be presented to the Legislature for consideration. First, however, the fullest publicity will be given to it, so that the people may understand all its provisions. For this purpose copies will be sent to the managers of all companies in the State, with instructions to make the contents public in the most effective way possible.

The bill will vest in the commission full power for fixing and regulating rates, which must be uniform in the locality for which they are determined. Giving away service or selling it at a ruinous price for the purpose of injuring a competitor will be prohibited. Violation of an order establishing a rate for the use of a company is punishable by a fine of $500 per day.

Absolute authority is given the commission to make investigations of the business of the companies. Its experts may be sent into the offices with authority to ascertain every detail of the business. Officers and employees may be summoned before the commission with books and records to testify in any hearings that may be held. Refusal to appear is punishable by a heavy fine. Upon the complaint of a subscriber of a company the commission is required to have a hearing and inquire carefully into the charges made. If sustained, the commission must then issue an order making the changes necessary to correct any wrongs and establish justice.

No provision is made for regulating the issue of stock and bonds, and the present law relating to franchises is to stand as it now appears on the statute books. The commission may, however, give advice on franchise matters and add its approval when granted.

The bill provides that companies whose lines intersect or whose systems have been established in the same locality may be consolidated, but the rates previously charged cannot be advanced without the consent of the commission. This allows the consolidation of Bell and Independent plants, and it is claimed that this feature is not open to the objections made to the Elson bill, defeated in the last Legislature, which was alleged to be a Bell measure.

Messrs. D. J. Cable, of Lima, chairman of the board of directors of the Ohio Independent Telephone Association; Frank L. Beam, president of the association, and S. E. Ward, of Mansfield, compose the legislative committee of this organization and the bill has been formulated through their work. It is said that Mr. C. A. Otis, president of the Cuyahoga Telephone Company, has been an important figure in the work and that through him President Theodore Vail, of the American Telephone & Telegraph Company, has been brought around to favor the measure. It is stated that there will be no opposition from the Bell interests to any feature of the bill.

It is claimed by some that 200,000 subscribers to Independent local exchanges have been connected with the Bell long-distance service within the past two years. This has come about through consolidations and contracts made since the decision of the United States Circuit Court to the effect that exclusive contracts for such service, thus cutting out competition, are not legal.

The Central Union Telephone Company controls all the Bell exchanges in Ohio, with the exception of those at Cleveland and Cincinnati. In the latter city there has never been any competition, as the Independents never succeeded in getting a foothold there. It is altogether possible that many consolidations in the smaller cities and towns would follow the enactment of this bill into a law, but just what the policy of the Bell people is for the large cities is not known. It seems to be their desire to get rid of all exchanges in the smaller places on condition that their lines secure the long-distance business. The question of what policy will be followed regarding the two long-distance systems will also be interesting. The United States Telephone Company might be absorbed by the American Telephone & Telegraph Company, but whether this is part of the plan remains to be seen. Nothing has been said as yet to indicate the course that will be followed in this respect.

New Jersey Commission News.

The Board of Public Utility Commissioners for the State of New Jersey has adopted as a uniform system of accounting for electric street-railway companies the classification of operating expenses, operating revenues and expenditures for road and equipment prepared as standard by the American Street and Interurban Railway Accountants' Association Oct. 15, 1908, with certain modifications.

The modifications apply particularly to the keeping of accounts for depreciation of way and structures and depreciation of equipment.

The board requires that in the account for depreciation of way and structures there shall be charged from month to month the amount estimated to be necessary to cover such wear and tear, obsolescence and inadequacy as have accrued during the month on all way and structures of the accounting corporation, less an amount equal to the sum of the amounts charged for that month to the various repair accounts in maintenance of "way and structures." For depreciation of equipment the board requires a charge to be made from month to month of the amount estimated to be necessary to cover wear and tear, obsolescence and inadequacy accruing during the month on equipment. From this there is to be deducted an amount equal to the sum of all the amounts charged during that month to various repair accounts in maintenance of "equipment." The amount estimated to be necessary to cover wear and tear, obsolescence and inadequacy for both maintenance of way and structures and depreciation of equipment is to be based on a rule to be determined by the accounting corporation, which rule is to be derived from consideration of the corporation's history and experience. A general statement of the rule in use by each company, together with the general information upon which it is based, is to be filed with the board.

The Public Utility Commissioners have granted certificates of approval to the Public Service Electric Company for the issuance, sale and delivery of $1,000,000 par value capital stock, and to the Hudson & Middlesex Telephone & Telegraph Company for the issuance, sale and delivery of $101,002 capital stock, par.

The board has approved the ordinance of the township of Deptford granting a franchise to the Gloucester County Electric Company and the agreement of merger and consolidation of the Rockaway Electric Light & Improvement Company and the Dover Electric Light Company.

Wisconsin Commission News.

The commission has authorized the Northern Hydroelectric Power Company to issue $300,000 par value of bonds, of the denomination of $1,000 each, to bear interest at the rate of 6 per cent per annum. This issue is to be made in accordance with the terms of a certain mortgage deed of trust issued to the American Trust & Savings Bank and Frank H. Jones, as trustee and co-trustee. The funds to be derived from the sale are to be used for the purpose of completing the company's plant at High Falls, Marinette County, Wis., and for the purchase of machinery.

The Legislature has confirmed the reappointment of Halford Erickson as a member of the Railroad Commission to succeed himself.

The commission has approved the flat rate of $6 per month filed by the Minehan Building Company, of Green Bay, for private street lighting. This rate includes the cost of erection, connection and maintenance of iron poles, each to support five 100-watt tungsten lamps, inclosed in globes. The service is to be furnished from dusk to midnight.

Pursuant to a formal agreement between the village board of Genoa Junction and the Genoa Junction Electric Light Plant, the determination of a fair and reasonable rate for street lighting was left to the commission. The company desired to increase the present rate of $10 per 32-cp lamp per year to $18. The commission, upon an investigation of conditions in Genoa Junction, found that the rates were low and the returns probably not reasonable, but on the other hand the service was found to be extremely poor and the plant operation and management very inefficient. The standards of service were not being maintained and no effort has been made to increase the commercial business in any way. Under existing conditions the commission suggested that a rate of $12 was all that the plant was entitled to under normal conditions and at this rate the plant must furnish adequate service.

The present board of water and light commissioners of Jefferson appear to be considerably opposed to the schedule of rates suggested by the commission last summer upon request of the municipal plant. The former board applied for and received permission to postpone the date upon which the new rules were to go into effect until Jan. 1, 1911. The rate schedule as proposed has not as yet been put in force. The present board complains that the proposed rates will increase the bills of a number of so-called large consumers and that as a result the plant will lose a number of these consumers. The rates as proposed by the commission, and which are based upon cost of service, would effect a material decrease in the bills of the small consumers and a material increase in the case of large consumers. The commission called attention to the fact that the present rates are very inequitable and unjust, for the small consumer is being charged an excessive rate, whereas the large consumer generally gets service at less than cost. It was pointed out also that the plant investment was excessive. With water rights the cost per kilowatt of station capacity is about $250. The average investment of fifty-four plants of 150-kw capacity in Wisconsin and Massachusetts is about $125 per kilowatt, as against $190 in Jefferson, exclusive of water rights. The average plant investment as reported by the Wisconsin commission is about $152 for a plant of 100 hp to 200 hp, $115 for plants of 200 hp to 300 hp, and $110 for plants of 300 hp to 500 hp.

In order to relieve the situation slightly the commission authorized a slight change in its former rulings with respect to the per cent of active load under the various classifications. The commission, however, emphasized the fact that the situation in Jefferson must be remedied at once if further proceedings are to be avoided.

Massachusetts Commission News.

The Boston Transit Commission has submitted its annual report for the year ended June 30, 1910. The work of the commission during the year in the field was mainly in connection with the construction of the Boston terminus of the Cambridge subway, which will probably be completed early in 1912. Considerable attention has been given in conference with officials of the Boston Elevated Railway Company to the details of the station to be built under Boston Common at Park Street, in connection with the incoming Cambridge and Riverbank subways, and the probable extension of the former to the South Station. It is probable that a substation below the present Park Street station of the Tremont Street subway will be built, with motor-driven escalators to facilitate egress. During the fiscal year the Boston Elevated Railway Company paid $211,750 for the use of the Tremont Street subway. The net toll receipts for the year in the East Boston tunnel were $117,751, and the cost of collecting tunnel tolls of 1 cent for each passenger was $19,034.

The Boston Elevated Railway Company in addition paid $404,924 for the use of the Washington Street tunnel during the year. The commission has made studies of a number of subway and tunnel projects during the year, sitting as a joint board with the Massachusetts Railroad Commission by order of the Legislatures of the two preceding years. The principal constructive recommendation resulting from these deliberations is that a subway be constructed by the Transit Commission between Park Street and the South Station, and that the latter be extended from the South Station to Andrew Square, Dorchester, to provide rapid transit between Dorchester, South Boston and the city proper.

The Public-Service Corporation and the Public.

Mr. Samuel Insull was the speaker at the luncheon of the Chicago Engineers' Club on Jan. 24. His subject was "'Relations of the Public-Service Corporation and the Public," and he said that the first essential in bidding for success on the part of a public-utility company is to furnish the best possible service at the lowest possible price. The business must be a monopoly in order to obtain the best results, and, therefore, the public has much to do with the question, for it has to pay for the unfortunate results of competition where competition exists. Considering specifically the production of electrical energy, Mr. Insull pointed out that to get the best results the entire production for a given area, not only for lighting but for transportation, manufacturing processes and all purposes, should come under one head. The speaker said that he was willing to advocate boldly a doctrine of monopoly as an economic proposition. He cited the example of Chicago in the central-station field to show the beneficent results of this policy.

In Chicago the central-station company has more than 125,000 customers and its maximum output is about 250,000 hp. For this year its output will be 25 per cent greater than the total output of the electricity supply companies of London, which has a population of 7,000,000 against Chicago's 2,200,000. The cash invested in the business in Chicago is about $70,000,000 and the output of the company doubles about every two and a half years. Mr. Insull gave some other statistics relating to the Commonwealth Edison Company and among other things mentioned the fact that the amount of coal consumed per unit of energy sold is now only about one-third of what it was eight years ago.

Returning to the broader aspect of his subject, Mr. Insull said that the point was not so much the relation of the public-service corporation to the public as of the public to the public-service corporation. The actual money invested in the public-service corporations of Chicago, excluding steam and interurban railroads and the suburban service of steam railroads, is between $450,000,000 and $500,000,000. The gross earnings of these properties are between $75,000,00 and $80,000,000 a year and for the last three or four years there has been expended for improvements from $35,000,000 to $40,000,000 annually. This amount has been increased by the recent rehabilitation work of the surface street-railway companies, but at the lowest estimate the future development of these properties will represent an expenditure of not less than $25,000,000 a year. The total number of employees is about 50,000, and taking an average of five to a family it will be seen that about 10 per cent of the population of the city depends for its daily bread upon the prosperity of the public-service corporations. If the steam and interurban railway companies are added it is probable that the proportion of the city's population dependent on these varied public utilities would reach not less than 20 per cent.

Thus it is a serious and a vital question that is presented to a city like Chicago by its relation to the public-service corporations. The failure of these enterprises would be a very serious matter, affecting general business conditions, and it is, therefore, evident that a policy of "live and let live" should prevail. Mr. Insull quoted with approval from an editorial in the Chicago *Record-Herald* of Dec. 30, in which it was declared that the question of rate-making, for instance, was an economic one and should not be made the football of politicians. In con-

clusion the speaker begged his hearers not to go away with the impression that he advocated the unlimited freedom of public-service corporations. On the contrary, he expressed himself as a strong believer in proper governmental regulation of all such enterprises. However, this regulation should not be a matter of political expediency, but should be based on what is economically right, fair and just, both to the consumer and to the investor. When this is done it will be found that the consumer will receive more satisfactory service at a lower price, for the reason that money will be cheaper if these questions are handled with broad public spirit and absolutely removed from political entanglement.

New York Commission News.

The Public Service Commission, Second District, has received five petitions from the New York Telephone Company in relation to the sales and mergers of the plants controlled by that company. A corporation has been formed, known as the Allegany Telephone Company, located at Wellsville, to which it is proposed to sell the plant and property of the New York Telephone Company situated in Allegany County, including the rights and privileges granted to the New York & Pennsylvania Telephone & Telegraph Company, the predecessor of the New York Telephone Company, by the villages of Wellsville and Andover. The price to be paid is $35,000. It is proposed to sell the Amsterdam Automatic Telephone Company to the New York Telephone Company for $150,000, and the merger is proposed of the Trumansburg Telephone Company, the stock of which is owned by the New York Telephone Company at present, and of the Jefferson County Telephone Company with the New York Telephone Company, the whole of the stock of the Jefferson County company being owned by the New York company at present. The commission is asked to transfer the property, rights and franchises formerly belonging to the Central New York Telephone & Telegraph Company in the City of Oneonta, Village of Unadilla, Village of Richfield Springs, Village of Laurens, Village of Cooperstown and Village of Walton, now owned by the New York Telephone Company, to the Otsego & Delaware Telephone Company for the sum of $98,000. The petition states that at Amsterdam and Watertown the majority of the subscribers of both of these companies have expressed their desire for the consolidation and unification of the systems. The company also alleges in its petitions that the transfer of the property in Allegany County, at Trumansburg and in Otsego and Delaware Counties permits it to be more advantageously and efficiently used and will prove of greater benefit to the subscribers under the plan now proposed by the company.

The Elmira Water, Light & Railroad Company has been authorized to issue 5 per cent first consolidated mortgage bonds to the amount of $243,995, to be sold at not less than 87. The proceeds are to be used for the discharge of indebtedness incurred for capital purposes and various extensions and improvements to its property in Elmira and vicinity. The Cliff Electrical Distributing Company, of Niagara Falls, has been authorized to issue its general mortgage bonds to the amount of $250,000. The bonds are to be sold at not less than 95 and the proceeds used to reimburse the corporation for payments made in additions and betterments of its plant.

The commission this week will give hearings on the application of the Orange & Rockland Electric Company for authority to make a mortgage for $200,000 and to issue bonds to the amount of $142,000 at present, and on the complaint of the president and trustees of the village of Ossining against the Northern Westchester Lighting Company as to the price of street lighting.

The Newburgh Light, Heat & Power Company has been authorized to construct a transmission line within a portion of the incorporated village of Walden in the town of Montgomery. This order is supplementary to an order made on July 25, 1910, permitting the company to construct its transmission lines only outside the corporation lines of the village of Walden.

Report of New York Public Service Commission, Second District.

The fourth annual report of the New York Public Service Commission for the Second District has been submitted to the Legislature. It covers the year ended Dec. 31, 1910.

Of a total of 944 corporations, municipalities and individuals engaged in furnishing public service that placed them under the jurisdiction of the commission, or incorporated to render such service, 301 were electrical corporations. There were in addition corporations which were engaged in combined electrical and other business and also a total of 145 telegraph corporations and persons subject to the supervision of the commission.

The expenses of the commission from its organization to the close of the last State fiscal year have been as follows: From July 1, 1907, to Sept. 30, 1908, $307,734; Oct. 1, 1908, to Sept. 30, 1909, $276,575; Oct. 1, 1909, to Sept. 30, 1910, $295,443. The total appropriation for the fiscal year ended Sept. 30, 1911, is $372,830, and for the ensuing year the estimate is $393,537. The foregoing figures do not include expenditures for grade-crossing eliminations.

Examinations with respect to safety of construction or operation were made of the high-tension lines or property of a number of electrical corporations. Seven investigations were made as the result of fatal accidents from electric shock. Plans are in progress for a systematic inspection of all electrical plants. As a preliminary step, electrical corporations have been required to report as to the joint use of overhead distributing systems with telephone, telegraph, railroad and other companies. In matters concerning several companies and involving adequacy and safety of service the commission required such reasonable improvements as were deemed necessary to promote the public interest, preserve the public safety, or to protect those using gas and electricity and those employed in the manufacture and distribution thereof.

Satisfactory results have followed the two years' trial of the system of company inspection under commission supervision of electric meters. Most of the companies have participated in good faith. The indifference of a few companies, however, has caused the commission to consider the necessity and desirability of putting the practice under orders. During the year eight corporations installed testing apparatus upon recommendation of the commission and twenty-five other corporations equipped themselves with additional instruments, making in all 235 corporations now provided with apparatus approved by the commission. The commission has tested 1739 station standards and certificates were issued for 1697, while forty-two were ordered recalibrated and thirty-six were calibrated by inspectors.

The monthly reports filed by corporations of consumers' electric meters show an increase of 6460 in the total number of meters tested during the year. The percentage of fast meters to the total in 1909 was 9.5 per cent; in 1910, 7.4 per cent; the percentage of correct meters for these years was 69.9 per cent and 75.2 per cent respectively. Upon its authority to establish rules and regulations to carry into effect the meter-testing provisions of the law, the commission adopted the rule that all electric meters shall be deemed to be correct whose registration is 4 per cent or less fast or slow. As against seventy-three electric meters tested in the preceding year upon complaints of consumers there were tested last year 130 meters, of which fifteen were found to be more than 4 per cent fast, thirty-five more than 4 per cent slow, two wrongly connected and seventy-eight correct within the allowable limits of error stated.

Tests on the watt-hour meters measuring the total output of electric energy from the central-station busbars have been made at two plants.

The commission states that the need of an electrical laboratory exists in connection with the system of inspecting electric meters, in special meter complaint work and in the investigations into adequacy of service. The equipment for this work comprises instruments of portable character for field work and certain primary standards for laboratory use against which the portable instruments are periodically checked for accuracy and kept in calibration. Four assistant electrical inspectors and a chief inspector are employed. The total expenditure to date for all of the electrical laboratory equipment used by the commission does not exceed $6,700.

Regarding the work of the division of statistics and accounts the report says: "After two years' experience it may be said that the efforts of the division are met by most of the corporations with which it has to deal in a spirit of courtesy and co-operation. The reports filed by a few indicate, however, that there is either an intent to evade the accounting rules or that there is a lack of knowledge as to their requirements. In some cases it has been impossible to secure corrections of apparent misstatements through correspondence; nothing short of an audit of the accounts in many of these cases would produce a correct statement. In other instances, particularly where the corporations have not sufficient business to justify the employment of experienced bookkeepers, the accounting order is taken as something impossible of comprehension. This is believed to be due, however, to a lack of application rather than to any fault in the system of accounts. With the limited force at its command the division has not been able to extend to the small corporations the assistance in arriving at a correct understanding that it would like to extend, but improvement in this direction is hoped for as a future possibility.

"During the earlier days of the commission, and until the corporations had been given sufficient time in which to familiarize themselves with the more extended form of reports prescribed by the commission, it has been deemed unwise to attempt to enforce compliance with the law by bringing suits for penalties for failure to file reports in the time prescribed by law. It is now believed that the time for such leniency has passed. The forms of annual reports have become substantially settled, corporations have had sufficient time in which to install the uniform system of accounts prescribed, have learned how to make the reports properly, and there is no longer any reason why they should not obey literally, except in isolated cases, the requirements of the law with reference to the time of filing the report. The policy of the commission hereafter will be to exact the penalty prescribed by law in cases of disobedience."

Of the issues of securities which the commission authorized from July 1, 1907, to Dec. 31, 1910, the following details are of interest: Electrical corporations, stock, $5,855,500, and bonds, etc., $30,241,869, a total of $36,097,369; gas and electrical corporations, stock, $798,700, and bonds, $11,219,205, a total of $12,017,905.

On the subject of gas and electrical rates the report says in part:

"The original systems of charging for electricity, the flat-rate and uniform meter-rate systems, have the defect that owing to the different hours and length of time of consumption some consumers are supplied unprofitably. The trend in later years away from these systems indicates an endeavor on the part of electrical corporations to make every consumer theoretically, if not actually, profitable. To separate the actual costs of reaching a consumer is practically impossible, so we find entering into the more recent system of rates arbitrary and sometimes inconsistent factors, as follows:

"1. It is estimated that on the average it costs more per kilowatt of demand to reach and supply a small consumer than a large consumer; upon this basis there is a discrimination consisting of discounts because of quantity used.

"2. It is estimated that a difference exists between consumers who are able to guarantee a maximum consumption and those who cannot guarantee a definite use. From this arises discrimination between contract and non-contract users; one consumer may become entitled to discounts because of a short use of a large demand, another because of a long use of a small demand; but the consumer who can guarantee neither of these conditions obtains either no discount or relatively a less discount.

"3. It is estimated that certain large consumers are entitled to unusual consideration; this leads to discrimination in favor of the large consumer, to whom special rates or concessions are given.

"4. It is estimated that competitive conditions must be recognized. To those who may readily supply themselves with light or power obtained from some other source an electrical corporation is apt to fit the price which the company must make to get their business to their actual conditions. In this way arise discriminations in favor of each consumer whose use of electricity will warrant the installation of his own source of supply, while a higher rate is maintained for those consumers whose supply the company controls.

"These examples suffice to show the extent to which differentials between classes of consumers have grown up, and indicate the wide field for differential rates between consumers in the same class. Such differentials mean discrimination. Whether they mean unjust or illegal discrimination, and if so the extent to which such practice may be engaged in, as well as the question of relative equity or fairness of the various methods of charge in use, may only be determined by careful inquiry and detailed expert analysis of the operating conditions and resultant rates."

Reference is then made to the work of the committee, composed of representatives of the commission and the corporations, which is considering the subject. Continuing, the report states as follows:

"It is of course obvious that to whatever extent, wilfully or without intention, unjust discrimination may be practised, rates or drawbacks given, or undue preference exercised in special rates or contracts, slow and unsatisfactory progress will be made in the correction of such conditions if dependence for their adjustment rests upon the individual instances that may be brought to the attention of the commission by complaining consumers or instances upon which the commission may stumble. It is equally obvious that a proper exercise of the broad powers of requiring rates to be filed and of prescribing rules and regulations to govern same will provide means of ascertaining in many, if not all, respects, instances of illegality, injustice and unwarranted inequalities. The commission has deemed it wise, therefore, that ample time should be taken to construct well and permanently the foundation upon which this important work will rest, that necessity may not arise for retracing subsequent steps by reason of inadequate and improper preparation."

From a table showing the proportion of stocks paying no dividends has been obtained the above information regarding electrical corporations.

FINANCIAL ANALYSIS OF ELECTRIC CORPORATIONS.

	Total Number Corporations.	Number Paying No Dividends on Common Stock.	Amount of Common Stock Paying No Dividends.	Number Paying No Dividends on Preferred Stock.	Amount of Preferred Stock Paying No Dividends.
Elec. corp. gross rev. $25,000 and over.....	39	29	$24,208,400	1	$2,000,000
Elec. corp. gross rev. $25,000 to $10,000.....	47	29	2,073,530	....	.....
Elec. corp. gross revenues under $10,000.....	77	65	1,607,950	....	.....
Combined elec. and gas corp. gross rev. $25,000 and over.....	30	18	21,083,400	4	2,880,400
Combined elec. and gas corp. gross rev. under $25,000.....	12	8	600,800	....	.....
Combined elec. roads and elec. or gas corp.....	7	5	3,150,000	1	2,029,000

AMERICAN ELECTRICAL ENGINEERS.

Paul L. Battey.

Paul Leon Battey was born March 11, 1876, at Marion, Kan. When about three years old his parents moved to Topeka, Kan., where he spent his early life, receiving his primary education in the graded and high schools. While in the high school he became deeply interested in the studies of physics, electricity and chemistry and finally decided to enter the electrical field for a career.

At the age of seventeen he entered the employ of the Edison Electric Illuminating Company of Topeka, Kan., as an office boy, successively occupying during the period of seven years he was employed by this company the positions of meter reader, wireman, troubleman and arc lamp repairer, head of meter department and supply stock, armature winder and motor repairer, draftsman, electrician and assistant superintendent. During this time he followed technical studies by night work in correspondence school and under Prof. A. St. C. Dunstan, of Kansas University, in Y. M. C. A. educational classes, with much experimental work in mechanics, electricity and

P. L. Battey.

chemistry. Later he taught the Y. M. C. A. classes in electricity and mechanical drawing.

In 1898 and 1899 Mr. Battey attended the School of Engineering, University of Kansas, at Lawrence, thirty miles from Topeka. During this period he remained in the employ of the Topeka Edison Company as supervisor of the meter department and on special improvement assignments, working Saturday and Saturday night and spending the rest of the week at the university. At the university, besides regular work, he carried on a series of photometric tests on a large number of commercial incandescent lamps of different makes, using a spectrum photometer and an original device designed and constructed in the university shops for ascertaining the average spherical candle-power at one reading.

In March, 1896, at the age of twenty, and a short time after the announcement of the discovery of X-rays, he took the first X-ray pictures in Topeka, using an incandescent lamp as a Crookes tube and an alternating-current, high-potential, high-frequency outfit built by himself. He built a Sprengel pump and made his own Crookes tubes, learning glass blowing from Prof. E. C. Franklin, of Kansas University, at night on visits to Lawrence, and made his own calcium tungstate crystals for the fluoroscope. For two years he maintained an X-ray laboratory, doing work for many surgeons throughout Kansas and Oklahoma. Later, upon leaving Topeka, the entire high-frequency outfit, which gave a 15-in. spark, together with wireless-telegraph and many experimental attachments, was presented to the engineering school of Kansas State Agricultural College at Manhattan.

While with the Edison company Mr. Battey designed and constructed several extensive electrical displays in connection with the annual flower festival, which attracted attention, and also a special display for the State upon the occasion of the reception of the famous Twentieth Kansas Regiment upon its return from the Spanish War. Among other special work was the complete rearrangement of several publishing and printing plants for electrical operation by individual motors. Later he had charge of the electrification of the Atchison, Topeka & Santa Fé Railroad shops at Newton, Kan., and in 1897 was sent to Las Vegas, N. M., to superintend the wiring of a large hotel there. The last year with this company was devoted almost entirely to the rehabilitation of the power plant and distribution system, which firmly fixed his purpose of continuing electrical engineering as a profession.

In September, 1900, Mr. Battey left Topeka to enter the power and light switchboard department of the Western Electric Company at Chicago as a draftsman, with the view of becoming more familiar with this class of work. Three months later, owing to the resignation of the chief of the department, he was put in charge of the design of power and light switchboards. During this time he attended night classes in electrical engineering at Lewis Institute. On April 1, 1901, he accepted a position with the Arnold Electric Power Station Company, of Chicago (later called The Arnold Company), as a draftsman, with which organization he has remained, successively as chief draftsman, assistant engineer, superintendent of construction and engineer in charge. In 1907 he became a member of the firm and chief engineer of the railroad and industrial department, having complete charge of this work.

During his connection with The Arnold Company Mr. Battey has had charge of the engineering and construction of over twenty electrically operated railroad shops and industrial plants of varied character, each with its respective power plant, as well as of power plants for other service. In many of these the general arrangement and many of the details were personally designed, and numerous original schemes and devices were worked out to suit the requirements of what was considered modern design suitable for high-efficiency results. A system of combined underground and overhead electrical distribution for use in shops has been successfully used in a number of plants. In 1904, when in charge of electrical work in connection with the hydroelectric plant of the Spring River Power Company at Joplin, Mo., he designed and constructed in the field a unique high-tension, portable steel substation for use in the mining district, placing several of these in service. In 1905, in connection with the Ivorydale shops of the Cincinnati, Hamilton & Dayton Railway, he developed a system of graphical construction reports and a complete and comprehensive plan of organization for the handling of the engineering and construction of a property, to the end that the entire force should be kept in close touch with the work, with an accompanying saving of time and expense. This system was described at the time in the technical press and received favorable comment here and abroad. Much attention has been given to the perfection of the system owing to the favorable reception and rapid development of the engineer-constructor method whereby one concern handles entire properties from inception to operation. His work has also included the preparation of many engineering reports upon all classes of electrical properties. He has contributed some articles to the technical press from time to time, but the actual carrying out of work has allowed little opportunity for writing for publication.

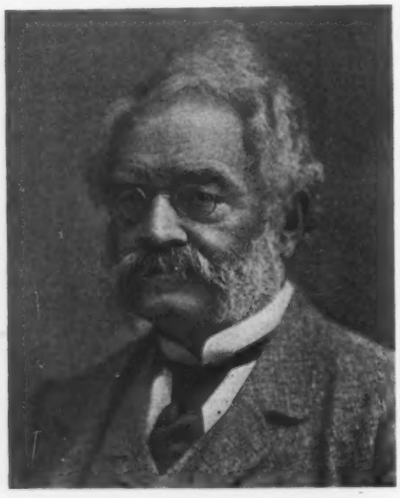
Mr. Battey is a member of the American Institute of Electrical Engineers, Western Society of Enginetrs, Illuminating Engineering Society, National Geographical Society, Chicago Electric Club and Chicago Engineers' Club.

THE GERMAN ELECTROTECHNICAL SOCIETIES.

HISTORICAL.

IN Germany the situation with respect to electrotechnical societies is somewhat complicated owing to the existence of a large number of such societies, which, moreover, are mostly bound together by mutual agreement, yet each retaining an independent organization. In order to understand this situation clearly, it is necessary to follow the historical development of the various bodies.

The oldest German electrical organization is the "Elektrotechnische Verein," which was founded in 1879. The name is due to Dr. Werner von Siemens, who coined the word "Electrotechnik" to designate the art of utilizing electricity, which at that time had ceased to be limited to telegraphy and electrolysis. Credit is also due to Dr. Werner von Siemens, one of the pioneers of electrical invention and founder of the well-known firm of Siemens & Halske, and to Dr. Stephan, the Imperial Postmaster-General, for the stimulation of interest in the project to bring together men interested in electrical engineering. These two gentlemen sent out a circular to representative men of



Dr. Werner von Siemens.

science, to members of the government telegraph staff and others interested in applied electricity, asking them to attend a meeting with a view to founding an electrical society. This meeting was held Dec. 20, 1879, among those in attendance being Aron, Frölich, Halske, von Hefner-Alteneck, Kirchhoff, Naglo, Paalzow, Slaby, Wedding, Wüllner and Zetzsche. Membership in the Elektrotechnische Verein thus founded was confined mainly to physicists, members of the government telegraph staff and manufacturers, though the army and navy were also well represented. Dr. Werner Siemens was chosen as president, and Dr. Stephan as honorary president. The purpose of the society was to further the development of the technical applications of electricity, to extend knowledge of electrical science, and by means of meetings to bring together German electrical engineers for the exchange of ideas through papers and discussions relating to their scientific, technical and commercial interests. The great interest which the young society aroused in technical circles, both at home and abroad, is indicated by the fact that at the end of the first year the membership had risen to 1550.

Most of the members lived outside of Berlin, and therefore could not regularly attend the meetings of the society. This led in the early eighties to the formation of similar societies in other large cities, among the first of which were the Elektrotechnische Gesellschaft in Frankfort-on-the-Main, the Elektrotechnische Gesellschaft in Cologne, and the Elektrotechnische Verein in Leipzig and Magdeburg.

The various independent societies early became aware that owing to the many economic and legislative situations arising from the extremely rapid development of the electrical industry a single organization was desirable which should represent the German electrical engineering profession as a whole in matters of national import. The Berlin society on account of its international membership could not well take the lead in achieving this end, and on account of the large number of scientific men and government officials in the membership a very lively interest in the economic questions involved could not be expected in this quarter.

The question finally became acute about the time of the Frankfort International Exposition (1891), when far-reaching electrical legislation was under consideration and it became absolutely necessary for the German electrical industry to take some action to protect its interests. In July, 1892, under the lead of Dr. A. Slaby, of the Charlottenburg Technical High School, and Mr. E. Rathenau, managing director of the Allgemeine Elektricitäts-Gesellschaft, a meeting of eminent scientific, technical and commercial men was called, at which a plan was drafted to unite the societies of Germany into a single organization. In accordance with this plan, at a meeting held in January, 1893, at which representatives from eleven electrotechnical societies were present, the Verband Deutscher Elektrotechniker was founded, with Dr. A. Slaby as first president. It may be added that, in addition to the two gentlemen above mentioned, those taking part in the founding of the new body included Budde, Corsepius, Hartmann, Heim, Kummer, Lahmeyer, von Miller, Naglo, Oechelhauser, Schuckert, von Siemens and Uppenborn.

The object of this organization was the union of the electrical engineers of Germany for the purpose of effectively representing and furthering German electrical engineering, and to provide for the formation of local societies wherever the need warranted. To-day the Verband Deutscher Elektrotechniker includes twenty-one societies in all parts of Germany, the relations of each to the main society being embodied in written agreements.

Before going further into the history of the different societies it should be mentioned that at the time of the organization of the Elektrotechnische Verein in Berlin a society periodical was founded and published under the name of *Elektrotechnische Zeitschrift*, the first issue of which appeared in 1880 with Drs. A. Slaby and Zetsche as editors. In 1890 this journal was consolidated with the *Centralblatt für Elektrotechnik*, and passed into the hands of Julius Springer, Berlin, the well-known publisher of technical books, this step having been rendered necessary on account of the increasing scope of the paper.

At the time of the founding of the Verband Deutscher Elektrotechniker the *Elektrotechnische Zeitschrift* was made the official organ of that society. Both the Verband and the Verein have an agreement with the publisher by which their members get the journal at a reduced rate, and the societies also share in the proceeds derived from advertisements. The *Elektrotechnische Zeitschrift* has now a subscription list of about 12,000, which includes a large number of subscribers in foreign countries, where the journal has a high standing. In its columns have appeared many scientific contributions of fundamental importance upon which our present-day knowledge is built. Among the early contributions may be mentioned articles on the work of von Hefner-Alteneck, on the early dynamos and arc lamps and a new light unit (Hefner-kerze); by Frölich on the measurement of large currents and on the first theory of the dynamo; by Neesen on lightning arresters, and by Aron on storage batteries and on his ampere-hour meter. Mention should not be omitted of the contributions of von Dolivo-Dobrowolski on revolving-field motors and the numerous articles on the dis-

tribution and transmission of electrical energy, based on experiments with the first high-tension electrical transmission system, installed at the exposition in Frankfort in 1891.

THE VERBAND DEUTSCHER ELEKTROTECHNIKER.

Anyone, whether living in Germany or in a foreign country, who has a scientific interest in electrical engineering or in any of its branches is eligible to membership in the Verband Deutscher Elektrotechniker. Authorities, corporations, societies and business houses, as well as individuals, are also eligible to membership. The greater part of the membership is enrolled in local societies of the Verband, which, as previously mentioned, includes, in addition to the Elektrotechnische Verein, twenty organizations. Following is a list of these bodies, with their respective membership:

Elektrotechnischer Verein, Berlin	1,738
Elektrotechnischer Verein, Aachen	89
Elektrotechnischer Verein zu Breslau	56
Dresdener Elektrotechnischer Verein	268
Elektrotechnische Gesellschaft zu Frankfurt	268
Elektrotechnischer Verein in Hamburg	168
Elektrotechnische Gesellschaft, Hannover	170
Hessische Elektrotechnische Gesellschaft, Darmstadt	66
Elektrotechnischer Verein, Karlsruhe	148
Schleswig-Holsteinischer Elektrotechnischer Verein, Kiel	40
Elektrotechnische Gesellschaft zu Köln (Cologne)	127
Elektrotechnische Gesellschaft zu Leipzig[1]	124
Elektrotechnischer Verein, Leipzig[1]	141
Elektrotechnischer Verein zu Magdeburg	98
Elektrotechnischer Verein Mannheim-Ludwigshafen	103
Elektrotechnischer Verein, München	122
Elektrotechnischer Verein am Niederrhein, Crefeld	80
Oberschlesischer Elektrotechnischer Verein	96
Elektrotechnischer Verein des Rheinisch-Westfälischen Industriebezirks, Essen	380
Elektrotechnischer Verein an der Saar, Saarbrücken	51
Württembergischer Elektrotechnischer Verein, Stuttgart	185

[1] The two societies in Leipzig have recently been amalgamated.

The members of these societies may apply for membership in the Verband, and for this privilege the society pays 2.50 marks (62 cents) per member to the Verband; and a member joining the latter body is entitled to the privilege of subscription at the reduced price to the *Elektrotechnische Zeitschrift*. The total membership of the Verband is at present 4653, of whom 4519 are members of local societies, the remainder, 134, being members of the Verband alone.

The most important event of the Verband year is the annual convention, which is usually held in the month of May, June or July in one of Germany's cities. The principal purpose of the convention, which continues three to four days, is the presentation of reports by various committees that have pursued certain work throughout the year, and the progress of which has been, from time to time, reported through the society's periodical. In addition to these reports, papers on live topics are presented, interesting installations are visited, and an opportunity is afforded members for the exchange of ideas and experiences. The program also includes pleasure trips and other social features, which serve to bring the members into closer personal touch with each other.

The conduct of the convention and the other business of the society is in the hands of an executive committee (called "Vorstand") consisting of a chairman, two substitute chairmen and four members, who are elected for two years at a convention. The chairman or one of the substitute chairmen is the legal representative of the Verband. In addition to the executive committee, there is a board of managers (called "Ausschuss") made up of members of the executive committee, ten members elected by the convention and a number of other members elected by the societies which belong to the Verband. The members of this board also hold office for two years. The local societies are allowed to have one member in this board for every 150 members of the society. At present the board is made up of fifty-one members. This board decides on all fundamental matters relating to the Verband, on proposals of the executive committee as well as of single members, and on proposals which are laid before it at the convention.

The method of election of the executive committee is as follows: The members in attendance at an annual convention receive from the retiring board of managers a complete nomination list giving definite recommendations for the make-up of the new executive committee. The formal election is then made simply by acclamation. As to the board of managers, only ten members are elected at the annual meeting, since the others are either members of the executive committee or are appointed by the branch societies. The names of the ten members to be elected are also proposed by the board of managers and these members are then elected by acclamation. The part which the members attending the annual meeting take in the elections is therefore a purely formal one.

When the executive committee has to transact business its members are summoned to a meeting. Aside from the annual meeting of the executive committee, which immediately precedes the annual convention of the Verband, the managers meet together only occasionally, when some important matter comes up which demands immediate action. This was, for instance, the case two years ago when action had to be taken concerning details of reorganization of the body. In such cases a meeting of the board of managers may be called on the motion of at least eight members of the board. The different members of the board are notified in advance by letter concerning the business to be transacted. In matters of urgency a vote by letter may be taken, in which case the chairman specifies a date by which the votes must be received.

Resolutions adopted by the executive committee are communicated by letter to the members of the executive committee and to all members of the board of managers. Every member of the executive committee has the right to send out circular letters through the chairman. A resolution of the executive committee is valid if four members are in favor of it, subject, however, to the provision that the other members must have had an opportunity to vote on the resolution. The board of managers can adopt resolutions if all its members have been notified ten days previously concerning the business to be transacted, and if at least one-half of the members are present. The resolutions of the board of managers are adopted by a majority of the board.

For the investigation and study of current topics the convention appoints special committees for a term of one year, which choose a chairman from the committee membership and hold meetings as the progress of their work demands.

All of the officials thus far mentioned are honorary and receive no pay. The general secretary, however, who is the executive officer of the society, receives a salary and he has a voice in the executive committee and in the board of managers.

The work of the Verband Deutscher Elektrotechniker has, aside from the holding of meetings for the reading and discussion of papers, covered a wide range of activity. Its "Specifications for the Installation of Electric Plants," the preliminary work on which is due to the Elektrotechnische Verein of Berlin, appeared first in 1896. They have steadily been kept up with the progress of the industry, and are accepted as standard by manufacturers, contractors, central-station managers and the local authorities. A similar work consisted in the formulation of "Specifications for Electric Railways"; "Specifications for the Operation of Electric Plants"; "Specifications for Overhead-Line Construction"; "Specifications for the Crossing of Power Lines and Telegraph and Telephone Lines"; "Specifications for the Crossing of Power Lines and Railways"; "Specifications for the Protection of Electrical Plants Against Abnormal Potentials"; "Specifications for the Protection of Metallic Underground Structures from Electric Railway Stray Currents," and "Standards for the Utilization of Electricity on Board Ship." Mention should also be made of the "Suggestions for Procedure in Case of Fire," "First Aid to Those Injured in Electrical Operation" and "Rules for Protection of Buildings Against Lightning," which were taken over from the Elektrotechnische Verein; also of the "Copper Standards," "Standards for Conductors," "Standards

for the Manufacture of Incandescent Lamp Bases, Plug Fuses, Plug Contacts, Insulating Tubes and Arc Lamps." A number of valuable test specifications, including specifications for transformer iron, construction material, and photometry of incandescent and arc lamps, have been drafted and have aided German manufacturers considerably in attaining their present high standard of quality. In fact, the Verband has conferred a great benefit on the German manufacturing industry by this work, which has tended to the national standardization of electrical apparatus. The specifications for rating and testing of electrical machinery and transformers have become standard in Germany and have been used as a model for similar specifications in other countries.

Important work has been accomplished by the Verband, acting in conjunction with other technical societies, as representative of the electrical industry in connection with government legislation for the regulation of electrical plants and central stations, and the taxation of plants on the basis of electrical energy output and lighting equipment. It has also promoted the education of workmen employed in electrical construction and operation and furthered the practical training of students. The activity of the Verband in broad educational matters is evidenced by its active co-operation with many other organizations; for instance, it is represented in the German Commission for Mathematical and Natural Science Studies, the Commission on Technical Intermediate Schools, the Commission on Units and Symbols, the Commission on Tests of Hauling Machinery, the Commission of German Insurance Protection Societies, the Commission of the German Museum and the Permanent Commission on German Industry. In the International Electrotechnical Commission, with headquarters in London, the Verband is represented in the council by Prof. E. Budde and Mr. G. Dettmar. A fund of 500,000 marks was left by Mr. Günther, the late editor and proprietor of the *Elektrotechnischer Anzeiger*, the proceeds of which are to be applied in aiding needy members of the electrical industry, especially mechanics and wiremen, and in assisting deserving men of this class to obtain a professional training. This fund is managed by the Verband under the supervision of the state. Another important work of the Verband is the collection and publication of central-station statistics, formerly published yearly in the *Elektrotechnische Zeitschrift*.

The income of the Verband is made up as follows: Dues from the local societies of 2.50 marks (62 cents) for each recorded member; dues of 30 marks ($7.50) from each member of the Verband; proceeds from the sale of specifications, rules, etc., and the Verband's share in the advertising business of the *Elektrotechnische Zeitscrift*.

According to the last report, the surplus amounted to $37,500. The income for the last year was $20,000 and the expenditures $12,750, leaving a balance of $12,500 for the surplus.

The president of the Verband Deutscher Elektrotechniker is Geheimer Hofrat Prof. J. Görges, of Dresden. He was born in Lüneburg in 1859, and after leaving the Gymnasium at that place studied mathematics and natural science in Tübingen, Göttingen and Berlin. After passing the state examination *pro facultate docendi* at the University of Göttingen, Mr. Görges, in 1884, entered the service of Siemens & Halske in their Berlin shops, where he spent two and a half years under Hefner von Altenek in design and investigation work. After the reorganization in the Charlottenburg shops of the firm, in 1889, Mr. Görges took over the direction of the designing and testing departments of electrical apparatus. He has paid particular attention to alternating-current problems, among which may be mentioned the construction of alternating-current motors. Later he also took up the development of patents for his firm, especially those having to do with polyphase currents. After seventeen years with the firm of Siemens & Halske Mr. Görges, in 1901, accepted a professorship of electrical engineering in the Technical High School in Dresden, and was made director of the new Electrotechnical Institute, which was built under his supervision. He still holds this position. Mr. Görges has contributed much to technical literature, among which articles on the following subjects may be mentioned: Measuring instruments, polyphase distribution systems, single-phase motors, theory of parallel operation, investigations of the starting characteristics of motors.

H. Görges.

J. Dettmar.

The general secretary is Mr. G. Dettmar, who is the author of "Explanations of the Specifications for Rating and Testing of Electric Machinery and Transformers." Mr. Dettmar succeeded Prof. Dr. Gisbert Kapp, now professor of electrical engineering at the Birmingham University and president-elect of the British Institution of Electrical Engineers, who was the first general secretary and served in that capacity for eleven years. At the annual convention at Braunschweig in June last Prof. E. Budde was elected president, his term of office beginning with the first of the year 1911.

THE ELEKTROTECHNISCHE VEREIN.

The Elektrotechnische Verein, which was founded in 1879, as mentioned before, has at present 2800 members, 1100 being in foreign countries. According to its by-laws, individuals, firms,

corporations or government authorities are eligible to membership, in so far as they have any interest in the purposes and publications of the society. Eligibility to membership is not limited by nationality. Application for membership requires the support of two members of the society. Different classes of members, such as are common in other societies, do not exist, with the exception of honorary membership, which is conferred in recognition of important work done. At present the only honorary member is Mr. Thomas A. Edison. Prof. Dr. Wilhelm Weber, Dr. F. von Hefner-Alteneck and Lord Kelvin, deceased, were the only other honorary members. In addition to honorary membership, however, there is also the office of honorary president. One of the founders of the Verein, Dr. Stephan, was the first to hold this office, and since his time the honor has been conferred on two other members, namely, the former Prussian Minister, von Podbielski, and Mr. R. Sydow, Minister of Commerce and Industry.

In honor of its twenty-fifth anniversary the Verein founded the Siemens-Stephan tablet, illustrated herewith, which is given to men who have made notable contributions to the electrical engineering profession as a whole, or have rendered great service to the society. This tablet, which is struck off in silver and bears medallions of the two founders, is awarded every five years. Up to the present time the medal has been received by Dr. Wilhelm von Siemens, second son of Dr. Werner von Siemens, and by Dr. E. Warburg, president of the Physikalisch Technische Reichsanstalt.

The business of the society is conducted by an executive committee (called "Vorstand") and a board of managers. The executive committee is made up of a chairman, two secretaries, a legal adviser, a treasurer and a manager. The executive committee is elected annually at the first regular meeting of the year by a majority vote of those present at the meeting. The chairman cannot serve more than two years in succession, and the board of managers (called "Ausschuss"), which works

Siemens-Stephan Tablet.

with the executive committee, is elected for three years and consists of forty-eight members. The chairman is chosen by the board from its membership, and the board appoints special committees to pursue certain investigations for the board.

The election of the executive committee takes place as follows: To the members who attend the election a nomination list prepared by the retiring executive committee is presented which contains the names of those proposed for the different offices. The formal election is then by acclamation. The board of managers is similarly elected. In this case one-third of the old members retire every year and a corresponding number of new members are elected by acclamation according to a nomination list proposed by the board of managers. The part which the members attending the election meeting take in the

President-Elect Dr. E. Budde.

election itself is therefore a pure formality in the Verein as well as in the Verband.

The work of this board, which meets once a month from October to May, inclusive, consists in the conduct of the meetings, determination of the order of business and subjects to be discussed, and passing on papers submitted to the society. The body also takes action on the proposals and reports submitted by the executive committee, and edits the publications of the society.

The society holds regular monthly meetings from October to May, inclusive, at which papers are presented and discussed. At these meetings progress reports of the various committees of the board of managers are submitted and discussed. At the annual meeting the outgoing executive committee submits its report covering the year and renders a financial statement. For the transaction of pressing business or the presentation of papers special meetings of the society may be called. The announcements and reports of meetings are published in the *Elektrotechnische Zeitschrift*, as are also the papers and discussions presented at the meetings. Of late years it has become a custom to hold an annual conversazione or social function, which is closed by a banquet. Sometimes new electrical devices are exhibited at these meetings.

Unlike similar institutes in other countries, the Elektrotechnische Verein has no home of its own. For years the meetings were held in the auditorium of the Royal Post and Telegraph Building, later in the Technical High School at Charlottenburg, and at present in the auditorium of the German Surgical Society in the Langenbeck House.

The dues for members are 20 marks ($4) and include a free subscription to the *Elektrotechnische Zeitschrift*. According to the last report of the society there is a surplus of $55,000. The income for the year was $27,000, of which about $22,500 was from membership dues, and the remainder from the society's share in the advertising profits of the *Elektrotechnische Zeitschrift*. The expenses for the year were about $12,500, leaving a balance of $14,500.

The society, through its papers, has done much to develop and disseminate knowledge on electrical subjects. Glancing through the columns of the *Elektrotechnische Zeitschrift*, the society's proceedings will be found to reflect truly the historical development of electrical engineering. Noteworthy among the earlier contributions are the previously mentioned papers of Fröhlich, von Hefner-Alteneck, Neesen, Aron and von Dolivo-Dobrowolski. Later were important contributions on the subjects of alternating current and direct current for central-station distribution, the effect of grounding the neutral in three-wire systems on telegraph and telephone circuits, the transmission of energy by high-tension alternating current, progress in electric machine design and especially in the single-phase motor for electric traction, and the epoch-making developments in the fields of electric lighting and wireless telegraphy.

Among the scientific work accomplished by the Elektrotechnische Verein may be mentioned investigations on earth currents and their relation to terrestrial magnetic phenomena, investigations on lightning and lightning protection. As a result of these investigations, the society published in 1886 and 1891 two pamphlets on lightning and methods to be pursued in protecting buildings from lightning, which later were taken over by the Verband Deutscher Elektrotechniker. Based on the same work were special instructions for lightning protection in factories of explosive materials. In connection with the lightning investigations, the effect of atmospheric electricity and abnormal rises of potential on electric transmission lines were studied in great detail. The society played a most important part in the fixing and legalizing of electric units in Germany. When, in 1886, Werner von Siemens conceived the foundation of a Physikalisch Technische Reichsanstalt for the preservation, testing and certification of electrical standards, and the government appropriated a large sum of money for this purpose, the Elektrotechnische Verein supported the movement in an active manner. Along this line also work is done in connection with the fixing of photometric standards, credit for which is largely due to von Hefner-Alteneck, The Hefner-kerze is to-day the working photometric unit of Germany.

The Verein took an active part in the preparation of rules for the installation of electric plants, which are issued by the Verband Deutscher Elektrotechniker. It also took part in the revision of the rules of the fire insurance companies regarding electrical installations in 1892. The work of the committee appointed to investigate stray currents from electric railways served as a basis upon which the Verband Deutscher Elektrotechniker formulated rules for the protection of metallic underground structures against electric railway stray currents. Of great scientific value is the work which was published last year under the title of "Definitions of the Properties of Electric Conductors."

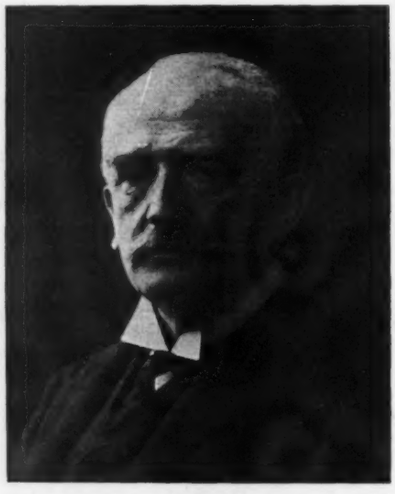
Finally, attention may be called to the society's attempt to establish a uniform system of symbols for the quantities used in engineering. This work is in charge of the committee on units and symbols, and represents most of the large technical societies in Germany, as well as those of Austria-Hungary and German-speaking Switzerland, with a total membership of about 60,000. The direction of this committee is at present in the hands of the Elektrotechnische Verein.

The Verein has taken part in expositions and congresses in Paris, Vienna, London, Frankfort-on-the-Main, Chicago, Genoa and St. Louis. In the International Electrotechnical Commission the Verein, jointly with the Verband, is represented by two members.

An important function of the Verein is the publication of the *Fortschritte der Elektrotechnik*, founded in 1887 by Dr. K. Strecker, which was taken over by the Verein in 1900. This publication, which is well known throughout the world, is issued quarterly and presents a digest of the world's electrical literature.

The president of the Elektrotechnische Verein is Geheimer Regierungsrat Dr.-Ing. Wilhelm von Siemens, the second son of the founder of the firm of Siemens & Halske. He was born in 1855, and after finishing his studies, which were confined principally to natural science, he became in 1884 a member and director of the firm of Siemens & Halske. He is at present a member of the board of directors of the Siemens & Halske Company, and also chairman of the board of directors of the Siemens-Schuckert Werke. One of his earliest contributions to electrical engineering was an investigation of incandescent lighting, with special reference to incandescent lamps connected in series, the result of which was embodied in papers presented before the Elektrotechnische Verein during the period from 1883 to 1888. Later Herr von Siemens did important work in connection with the utilization of polyphase currents for electric traction service. It is due to his influence that the celebrated high-tension, high-speed electric traction experiments on the Marienfelde-Zossen line were carried out. He also rendered valuable service in the development of the Siemens high-speed printing telegraph. Outside of the electrical engineering field Herr von Siemens has taken an active part in relation to national economic questions, and among his writings in this connection may be mentioned those on the right of employees to their inventions, suggestions for national financial reforms and criticism of the tax on electric energy.

As will be seen from the above, the Elektrotechnische Verein in Berlin is the oldest and by far the most important member of the Verband. With reference to number of members, the



President of the Elektrotechnische Verein.

Rheinisch-Westfälische Verein comes second, its territory being the West German coal and iron fields, where electrical energy is widely used for industrial purposes. The next largest societies are those in Dresden and Frankfort-on-the-Main. The Elektrotechnische Gesellschaft zu Frankfurt was originally intended as a branch of the Berlin Verein, and is the oldest provincial society, having been founded in 1881. It took an important part in the development of the electrical industry, and it was through its influence that the works of the great firm of Lahmeyer were located in Frankfort. The memorable Frankfort Exposition and the International Congress of 1891, with its epoch-making experiments in electric power transmission, are also to be credited to the initiative of the Frankfort society.

OTHER GERMAN ELECTRICAL SOCIETIES.

This article would not be complete without mention of certain other electrical societies which are not in alliance with the Verband. One of the most important of these is the Verband der Elektrotechnischen Installationsfirmen in Deutschland, which was founded in 1902. It is made up of representatives of contracting firms, and has at present about 350 members. Its quarters are in Frankfort-on-the-Main, and its president is Mr. G. Montanus. In the same year there was founded the Verein zur Wahrung Gemeinsamer Wirtschaftsinteressen der Deutschen Elektrotechnik, the membership of which is made up of those

interested in the manufacture and sale of electrical apparatus. There are at present 120 members, with headquarters at Berlin. The president is Dr. E. Sieg, president of the Hagener Storage Battery Works, in Cologne. A society representing similar interests is the Vereinigung Deutscher Elektricitätsfirmen, with headquarters in Berlin, the president of which is Prof. Dr. E. Budde.

Representatives of central stations organized themselves into a society in 1891 under the name of the Vereinigung der Elektricitätswerke, with headquarters at Dresden. The president of the society, which numbers about 400 members in Germany and abroad, is Mr. W. Meng, president of the Municipal Electricity Works in Dresden. It should be mentioned that this organization publishes an annual statistical report on the working results of central stations, which is of great value to those engaged in the design and operation of such plants.

The three societies above mentioned are primarily commercial in character. In contradistinction to these should be mentioned the Verein Beratender Ingenieure für Elektrotechnik, whose headquarters are in Berlin. The purpose of this society is to represent the interests of consulting electrical engineers and further the perfection of electrical and mechanical details of plant design. The consulting engineer in Germany is a much less important factor than in England, which fact, together with the very strict requirements for membership, which include scientific education, practical experience and absolute commercial independence of members, accounts for the small number of members in this society, which is at present only thirty-two. The society was organized in 1902, and Dr. E. Müllendorff, of Berlin, is president.

CURRENT NEWS AND NOTES.

Meeting of New York Section, I. E. S.—The regular monthly meeting of the New York Section of the Illuminating Engineering Society will be held on Feb. 9 in the Dungeon of at Castle Cave, 271 Seventh Avenue, at 8:15 p. m. The subject of the evening will be "Light and Architecture." Mr. Henry Hornbostel, of the architectural firm of Palmer & Hornbostel, will lead the discussion.

Southwestern Electrical and Gas Association.—The seventh annual convention of the Southwestern Electrical & Gas Association will be held in Houston, Tex., on April 27-29, 1911. This association, composed largely of Texas men, lays claim to being the strongest and most active State association in the United States, and its meetings are well attended and enthusiastic. Mr. D. G. Fisher, 1316 Commerce Street, Dallas, Tex., is third vice-president and secretary of the association.

Electric Signs and Poetry.—The *Commercial Appeal*, of Memphis, Tenn., prints in its issue of Jan. 15 a poem of seven stanzas by Miss Lucile Dillard Barron, entitled "Lights of Main," which gives expression to the emotion inspired by the sight of the electric signs on the main street of Memphis, whose "dazzling, witching glow set the world a-tingle and the peeping stars bade go." Among the sights sketched are "a bubbling fountain, foaming, sparkling, all ablaze, spilling out its cooling waters in a swirling, dreamy maze," and "a wondrous star arising, as a jewel magic made, and poured upon the clearings its luminous cascade."

Philadelphia Electrical Show.—Practically all of the floor space has been taken for the coming Philadelphia Electrical Show. The three local public-service corporations in the city—the Philadelphia Electric Company, Philadelphia Rapid Transit Company and Keystone Telephone Company—will take an active part in the exhibition, and the City of Philadelphia will also have an exhibit. The University of Pennsylvania will have an exhibit, as will also the Franklin Institute, the Spring Garden Institute and the International Correspondence Schools. The Philadelphia Electrical Contractors' Association will, as last year, exhibit as an association. Philadelphia is practically an untouched field for the electric vehicle for both commercial and pleasure purposes and it is expected that many types of up-to-date cars will be shown in the coming exhibition. The fact that the exhibition was planned, projected and the exhibitors procured in the space of less than two months is a tribute to the co-operative spirit of the electrical fraternity of Philadelphia.

Electric Advertising by an Airship.—The great airship of the Parseval Air Transportation Company appeared on New Year's eve over Berlin, Germany, and passed over the main streets unusually close to the ground. On each side of the huge bag were stretched large canvases of glittering stuff, on which appeared in great letters of light the words "Prosit Neujahr," meaning "Happy New Year." The ship had just returned from its gas-charging station at Bitterfeld, about 150 miles from Berlin, and the display caused a great sensation. The ship took its course to the royal castle, circumnavigated that and other important buildings, and finally returned to its station at Johannisthal. The lighting was accomplished by an electric generator in the car, taking sufficient power from the airship motor to produce electricity for two searchlights, one on each side. The outlines of the car were marked by incandescent lamps of various colors. This method of advertising is patented by the Air Transportation Company, Charlottenburg, Germany.

Corporation Industrial Education.—The *Proceedings* of the Boston convention of the National Society for the Promotion of Industrial Education, just issued, contains several papers, with discussions, on industrial training. Mr. M. W. Alexander, of the General Electric Company, West Lynn, outlines the general principles and requirements of apprentice instructions; Mr. Tracy Lyon, of the Westinghouse Electric & Manufacturing Company, describes the training which the Westinghouse company offers its apprentices, and Mr. George C. Cotton, of the Solvay Process Company, Syracuse, describes the apprentice training carried on by his company. Other papers are on apprentice instruction carried on by the Atchison, Topeka & Santa Fé Railway system and by the North End Union, a corporation apprentice school conducted by a number of employers of Boston to give training for the printing trades. Among those discussing the various papers were Prof. Sydney Ashe and Messrs. Walter B. Russell, Henry Abrahams and G. M. Basford.

Depreciation of Buildings and Machinery.—Mr. H. F. Donaldson, chief superintendent of the Royal Ordinance Factories, read a paper on Jan. 12, 1911, before the (British) Junior Institution of Engineers, entitled "Depreciation of Buildings and Machinery." The author contended that depreciation funds are not, and ought not to be, matters which interest only the accountant. He proposed a method of calculating the depreciation based essentially on assigning a certain definite percentage of depreciation in value each year rather than a certain constant amount of depreciation to cover the whole cost of equipment at the end of a specified period. For example, rather than assign a depreciation of 33 1-3 per cent of the initial value each year, it is better to estimate 40 per cent of the value year by year. In the former case the values year by year would be 100 per cent, 67 per cent, 33 per cent and 0.0 per cent; in the latter case the values would be 100 per cent, 60 per cent, 36 per cent, 21.6 per cent, 13.0 per cent, etc. An outline was given of methods for determining the value to be assigned to the depreciation of various machines and buildings used for industrial purposes.

New Street Railway Tunnel in Chicago.—The new Washington Street tunnel under the South Branch of the Chicago River was used for the first time on Jan. 29. It is used by the Chicago Railways Company for street-railway service and is built in such a manner that it may form a part of the proposed Chicago passenger-railway subway when the latter is built.

Joint Meetings in Chicago.—The joint meetings of the Chicago Section of the American Institute of Electrical Engineers and of the Electrical Section of the Western Society of Engineers will continue to be held at the rooms of the latter during the remainder of the season. The February meeting will be addressed by Prof. C. F. Burgess, of the University of Wisconsin, and his subject will be *Electrolysis of Iron and Concrete.* Mr. C. D. Haskins, of Schenectady, will be the speaker at the March meeting, his subject being *Electricity and War.* At the April meeting Mr. August C. Smith, of the Cataract Power & Conduit Company, of Buffalo, will speak on *Electricity in Ice Plants.*

Illinois Society of Engineers.—The twenty-sixth annnual meeting of the Illinois Society of Engineers and Surveyors was held in East St. Louis on Jan. 25-27. Nearly all of the papers presented related to civil engineering, although in his historical review Prof. I. O. Baker, of the University of Illinois, referred to the remarkable development of the electric railway motor in the life of the society. Prof. William H. Burger read a paper on the College of Engineering at Northwestern University, Evanston, Ill. This is a new engineering college with two courses—one a five-year course in mechanical and electrical engineering. The work of the first four years fulfils the requirements for the degree of bachelor of science, while on the satisfactory completion of the fifth year of work the College of Engineering will confer the degree of civil or electrical engineer. The new president of the Illinois Society of Engineers is Mr. J. G. Gabelman and the secretary is Mr. E. E. R. Tratman, both of Chicago.

Minneapolis Electric Show.—The second annual Minneappolis Electric Show, given by the Northwestern Electric Show Association, was opened in the National Guard Armory in Minneapolis on Jan. 26 and will be closed on Feb. 4. There are about sixty exhibits, embracing a number of prominent electrical manufacturers and dealers. Prof. H. T. Plumb gives popular lectures on electric phenomena in the afternoons and evenings. A large variety of applications of electricity are exhibited and also a number of electric automobiles. The interior lighting effects are very successful, the central feature being a beautiful combination of white and colored lamps in the dome of the building displayed against a black cloth canopy as a background. In each of the four corners of the building is a somewhat similar cluster of lamps, and these are connected with the centerpieces by lines of light, which alternately appear and disappear. The combination makes a beautiful and spectacular illumination.

Electrical Show at the Georgia School of Technology.—An electrical show of unusual interest was given by the senior students of electrical engineering at the Georgia School of Technology in Atlanta Jan. 13, at which there were twenty-three working exhibits and demonstrations, with a student in direct charge of each. These exhibits ranged from electric welding appliances to a stereopticon lecture, the performance being continuous. A feature of the evening's entertainment was a luncheon partly prepared by electric cooking utensils, at which over 300 guests were seated. Several of the Atlanta firms manufacturing electrical apparatus had working exhibits with their representatives in charge. The first and second floors of the Electrical Building at the "Tech." were crowded during the show, the audience being remarkable for the number of elderly persons who took advantage of this opportunity to acquaint themselves with the manifold applications of electricity.

Minnesota Electrical Association.—The annual convention of the Minnesota Electrical Association will be held in the St. Paul Hotel, St. Paul, Minn., on March 14-16. Mr. T. C. Gordon, of Little Falls, Minn., is secretary of the association.

Results of Meter Tests in St. Louis.—During the year 1910 the Union Electric Light & Power Company, of St. Louis, tested 40,046 customers' watt-hour meters. Taking 96 per cent as the standard of accuracy of this total, 8.1 per cent were fast, the inaccuracy being in favor of the company, while over twice as many were slow, the error in this case favoring the customer.

Popular Lectures for Central-Station Men.—The electrical engineering department of the University of Illinois is considering the advisability of giving a series of six or eight popular lectures to central-station men of the State. These lectures would occupy two days' time, and would deal with such practical problems as central-station economics, illumination and the resuscitation of injured men. Under central-station economics will be discussed the relative advantages of reciprocating engines, high-pressure, low-pressure and mixed-pressure turbines, the effect on coal and steam consumption of high-vacuum, superheat and boiler pressure. The lectures in illumination will deal with the comparative costs of different illuminants for exterior and interior lighting. A practical demonstration of the use of the luminometer will be given. The resuscitation of men will be discussed and practical demonstration will be given with and without apparatus designed for the purpose.

Plan Transferring Detroit to Eastern Time to Save Daylight.—A proposal to set the hands of Detroit clocks ahead one hour, transferring the city from Central to Eastern standard time, has obtained the approval and encouragement of the Detroit Chamber of Commerce and other public organizations and now seems likely to be established. Its advocates reason that if the city should adopt the earlier time business would commence earlier in the day, leaving more daylight to be enjoyed after offices, shops and factories close in the afternoon and also saving much of the cost of artificial illumination. The translated hourly schedule will apparently benefit the central-station load curve. The earlier closing of factories will relieve its lines of certain factory lighting demand that comes during the peak load but is not considered especially profitable. The peak of the service supplied to the street railways will also be advanced earlier in the day, partially removing it from the peak load of the lighting system. The trailing profile of the evening peak will be lowered, but this will have the effect of also lowering the extreme peak on the station, for which a large investment in generating machinery must be held in reserve. On the other hand, the morning lighting curve will be substantially raised, as houses and stores will be lighted up with the earlier beginning of business. This demand will come at a time, of course, when there is ample generating capacity available and should aggregate in kw-hours approximately that removed from the evening peak. The change of one hour to Eastern time will bring Detroit clocks into agreement with those at Windsor, but viewed from the American shore of Lake Erie Detroit will present the anomaly of being the only city west of Buffalo, from which it is about 300 miles distant, using Eastern time. It is only within a few years that Detroit has become changed wholly from local sun time to standard time, this being preceded by a period during which conservatives who clung to the old setting caused such confusion that one horological wit erected a clock downtown with five hands, showing Eastern, Central and sun times.

Chicago Engineers' Club.—The Chicago Engineers' Club has under consideration the project of erecting a building for its own use to be located near the Union League Club in Chicago.

Control of Energy Transmission in Maine.—A resolution providing that no corporation engaged in the transmission of energy shall be granted unrestricted rights of eminent domain nor transmit energy beyond the limits of the State has been passed by both the House and the Senate in Maine.

Grounding in Denver.—The Denver Gas & Electric Company has finished grounding its secondaries throughout the city. The Denver city ordinance requires the grounding of wiring conduit to water service outside of the water meter, and the grounding of interior circuits is also progressing rapidly.

New Engineering Shops for Cornell.—For the purpose of providing a building to house the shops of the Sibley College of Engineering at Cornell University Mrs. Florence O. R. Lang has donated $50,000. The building will be erected in memory of Mrs. Lang's brother, Jasper Raymond Rand, Jr., of the class of 1897, Sibley College. Her father, Jasper Raymond Rand, and her uncle, Addison Crittenden Rand, founded the Rand Drill Company, now merged in the Ingersoll-Rand Company.

Valuation of Public-Utility Properties.—Mr. Horatio A. Foster recently delivered an address before the students of the Throop Polytechnic Institute, Pasadena, Cal., on the subject of the valuation of public-utility properties. Included was a digest of some of the notable court decisions on details of valuation, etc. The address, together with one by Dr. Henry S. Carhart on "The Twentieth-Century Engineers," has been printed as Bulletin No. 49, and will be sent to any one interested upon application to the secretary of the institute.

Hotel Bibles Increase Electric Bills.—An immediate result of the work of the Gideons, a religious society of traveling men, in placing Bibles in the guest-rooms of hotels in large cities, according to the *Evangelical Messenger*, has been the increase at once noted in the electric lighting bills of the hotels supplied. One landlord in St. Louis is quoted as saying: "The change I first noticed after the Bibles were placed in the bedrooms of my hotel was that my electric bill doubled. The men go on reading and my electric light bill goes on getting bigger."

Los Angeles Aqueduct Power Question.—It is proposed to submit to the citizens of Los Angeles at an election to be held March 6 the question whether the electrical energy obtained by the water-power development of the Los Angeles Aqueduct, now building, should be sold to existing electrical companies or distributed by the municipality. The manner of handling this energy is still unsettled, and it is said that the companies would like to delay the date of submitting the proposition to the people to study and explain their position more fully. The city authorities, however, are believed to be in favor of presenting the question to the voters on the date mentioned.

Returns from Public-Utility Investments.—This is the season when candidates for the mayoralty in Chicago announce their principles in ringing tones. Four of these gentlemen have delivered their pronunciamentos. One is Mr. Carter H. Harrison, former Mayor, who is still, as he has been for a number of years, for public ownership "at the earliest possible moment." That sounds reminiscent, but one sentence from Mr. Harrison's platform is of present-day interest: "In the early days when public utilities, such as the traction, the telephone, the electric light and the gas companies, were still in an experimental stage, because of the risk run, a higher rate of interest on the investment was to be expected than would be fair to the consumer to-day, when with good management returns are as certain as is the interest on the national debt."

Water-Power Studies in New York.—In his annual report to the New York State Water Supply Commission Mr. Walter McCulloh, consulting engineer of the commission, gave the results of water-storage and power surveys made during the year on the Black River, the Oswego-Seneca Rivers and their tributaries, including the Finger Lakes, a survey of the Hudson River from Hadley to Troy, and a survey on the Genesee River at Mount Morris and Rochester. Reservoirs at Hawkinsville and Higley Mountain on the Black River would add 7915 hp and 7200 hp to the minimum flow of the river at costs of $2,800,000 and $1,340,000 respectively. On the Hudson River between Hadley and Troy 27,165 hp could be added to the present 131,697 hp by means of proper storage facilities. According to the report the mean annual dependable precipitation throughout New York State is 38 in.

Circuit Court to Pass on Fellow-Servant Case.—In May, 1907, Hugh Massey, a lineman's helper, working on a "dead" 2300-volt feeder of the Milwaukee Electric Railway & Light Company, near West Allis, Wis., was killed when a switchboard operator several miles distant closed a switch, energizing the line. When the case was first brought against the company by the dead man's mother a judgment of nonsuit was entered for the company, but an appeal was taken to the Supreme Court of Wisconsin. Here the judgment was reversed and the case has now been brought back to the Circuit Court, Judge Eschweiler, of Milwaukee, presiding, for a jury trial. The outcome of this case hinges upon the ruling whether the switchboard operator responsible for the lineman's death can be construed to be a vice-principal with the company, or whether, as a fellow-servant, the company is freed of responsibility for the accident.

Chicago Commercial Vehicle Show.—At the exhibition of commercial motor vehicles to be given in the Coliseum, Chicago, during the week of Feb. 6-11 under the auspices of the National Association of Automobile Manufacturers there will be shown a number of electric vehicles, including an electric hearse. There will also be several different police-patrol wagons and motor-driven ambulances, both gasoline and electric. Unusual interest throughout the country is reported in the subject of motor wagons for municipal purposes, and undoubtedly one result of the Chicago show will be a great increase in the number of such machines in use in different cities. An electric truck designed especially for use in factories and warehouses, railroad stations and steamship docks will be shown. The platforms of these trucks are only 2 ft. above the floor and their maximum speed is four miles an hour. They are made narrow so they can run up and down the aisles of the factory, and are steered by the front and rear wheels so they can turn very short corners, being operated from either end.

Transmitting Telegrams by Telephone.—It is reported that the Western Union Telegraph Company may discontinue telephoning messages received by telegraph, where practicable, instead of delivering them by messenger. It is said that in some cases the practice has resulted in the contents of telegrams being divulged to servants and other unauthorized persons. The telegraph company says that the plan arose not from a desire to effect economy, but to expedite the service and to meet the convenience of the public. Mr. G. E. Paine, general superintendent of the Postal Telegraph-Cable company in Chicago, writes to the daily newspapers in that city to say that the discontinuance of this service refers to the supposed possibility of making the telephone and telegraph practically one machine, supplanting the messenger service. He adds that the Postal company has always used the telephone to a certain extent in receiving and delivering messages, when desired by patrons, and that this practice will be continued. The plan of extensive complementary service of the telegraph and telephone was not adopted by the Postal company last summer, he says, but was devised by the Bell telephone and Western Union telegraph interests after their combination.

New Flaming Arc-Lamp Electrode.—A patent was granted Jan. 24 to Mr. Miner W. Allen and Mr. Wallace T. Conn on an improvement in electrodes for flaming-arc lamps which consists in providing the electrode with a metallic wire extending from end to end, the object being to decrease the resistance of the electrode.

Utilities Board in Maine.—The Democrats of the Maine Legislature have declared in favor of a Public Utilities Commission of five to supplant the present Railroad Commission and also to have supervision over all other public-service corporations, including regulation of rates. The bill is drawn on the lines of the Wisconsin law with modifications in accordance with the Ohio bill.

Electrical Energy for Steel Making in Norway.—Electrical energy for use in making steel at Stavanger, Norway, will be purchased at the rate of $6.70 per hp-year for the first 1500 hp and $5.35 for 1000 hp more; 10,000 hp will be available when needed. The steel plant, which is to be constructed by the Stavanger Electro-Staaverk Company, will be completed by August, 1911. The yearly output will be 1400 tons high-grade steel billets, 600 tons steel castings, 300 tons hammered steel and 700 tons refuse for resmelting.

Substitute for Radium for Medical Purposes.—Prof. E. Rutherford, director of the physical laboratories of the University of Manchester, has announced the development of a practicable method for producing mesothorium, a substitute for radium. The new substance is said to be quite as good as radium for medical purposes and much cheaper, and can be extracted from thorium, a heavy metallic powder of an iron-gray tint, which burns brilliantly in air or oxygen and which is extracted from thorite, which is found in Norway.

Telephone Girl Signs a Bond to Remain Single.—If the newspapers may be believed, a young woman recently employed by a Spokane (Wash.) hotel as a telephone operator was required to give a $500 bond not to marry within six months from the date of her engagement, the word "engagement" being used here in a strictly business sense, of course. The reason given for this unusual requirement is that half a dozen telephone girls employed in this hotel have resigned to get married within as many months. Telephone companies often complain that it is difficult to keep their young women operators, owing to the predilection which the girls seem to have for a matrimonial career, but the idea of restraining them from this course by contract is a new one.

Educational Meetings for Detroit Electrical Workers.—The Detroit local union, No. 18, of the International Brotherhood of Electrical Workers holds weekly meetings with programs of an instructive nature, at which practical talks are given by men of local electrical prominence. The nature of these addresses and the subjects involved are, of course, arranged to interest and instruct the audiences at the meetings, which are largely made up of electricians' helpers. On Wednesday, Feb. 1, Mr. W. T. White, electrical engineer of the Murphy Power Company, Detroit, gave a talk on "First Principles of Electrical Apparatus." Other speakers before the meetings have been Messrs. Alex. Dow and R. S. Stuart, of the Detroit Edison Company; Mr. Frank Mistersky, superintendent of the public-lighting system, and Mr. M. A. Allison, master mechanic of the Ford Automobile Company.

Electricity and Fence-Wire Rust.—Investigations to discover the causes of rusting in galvanized fence wires have been undertaken by the agricultural engineering department of the University of Iowa, at Ames, Ia. It has been well known that the lower wires of the fence, down among the moist grasses and weeds where rusting action would be expected to be most active, invariably last longer than the upper wires in the dry air. Mr. M. L. King, experimentalist for the department, says that he has found that these lower wires in fences of any length ordinarily carry small currents of electricity, reaching in some cases a value as high as 0.001 of an ampere, and sometimes showing a difference of potential of as much as 1 volt above ground. Such currents are absent in the upper wires, and it has been suggested, but not proved, that the greater preservative action of the lower strands is due to the suppression of local electric couples by the through currents flowing in the lower wires.

Mississippi Electric Association.—At a meeting of the executive committee of the Mississippi Electric Association held at Meridian, Miss., Jan. 19, 1911, Gulfport, Miss., was selected as the next place of meeting of the annual convention and June 20-21 selected as the dates. The following subjects were selected for papers to be presented at the convention: Engines of 750 kw and under; steam turbines, 750 kw and under, non-condensing and condensing; low-pressure turbines in connection with engines of 500 hp and less; electrically heated appliances; engineering department of National Electric Lamp Association; relation of employees to the company and to the public; the necessity for a commercial department. A committee was appointed on National Electrical Code requirements, and an appropriation was made for conducting a question box. The unanimous consent of all the member companies of the association having been obtained, it was voted to affiliate with the National Electric Light Association as a State section. Resolutions on the death of Mr. J. A. Jones, vice-president of the Gulfport & Mississippi Coast Traction Company, were adopted.

Dr. Steinmetz Before Toledo A. I. E. E. Branch.—Dr. Charles P. Steinmetz, of Schenectady, N. Y., addressed the Toledo Branch of the American Institute of Electrical Engineers Friday evening, Jan. 27, on the subject of "Some Phenomena of High-Power Circuits." More than 150 engineers and others of Toledo and vicinity were present at the meeting and attended the informal reception and smoker held afterward at the Toledo Club. Dr. Steinmetz discussed the various losses occurring in low-potential and high-tension circuits, including leakage, corona, etc., and gave some striking comparisons of the power quantities which may be involved in the effects of line surges. The speaker also referred to the continuing advances of transmission potentials, and outlined some of the problems which will require solution if the present rate of voltage increase is to be kept up. After his formal lecture Dr. Steinmetz was the target of a wide range of inquiries on electrical and engineering subjects, and escaped from his inquisitors only in time to catch his midnight train East. The meeting of the Toledo Branch Friday evening, Feb. 3, will be addressed by Mr. Harry Caird, of Toledo, on the subject of "Flaming-Arc Lamps."

New Type of Metallic Filament.—A patent was granted Jan. 24 to Mr. Orlando M. Thowless, of Newark, N. J., on an incandescent filament produced from powders which are not readily made into filament form by ordinary methods, either through lack of ductility or because of the necessity of long and expensive processes. A hollow cylinder of a ductile metal, such as aluminum, is packed with metallic tungsten in powder or with powdered tungsten and powdered oxide of thorium intimately mixed. After the air or gases are exhausted the packed cylinder is drawn down as though made of solid metal to the requisite filamentary diameter. The result is a tubular shell of aluminum containing all through its interior a dense, uniform, continuous conductive core of highly refractory material. The filament is then cut and formed into the proper shape for electric incandescent lamps, after which the aluminum part is removed by the passage through it of an electric current or by means of suitable solvents. This may be done after the filament is mounted in the lamp bulb during the process of exhaustion, following which the filament may be raised to a very high temperature for the purpose of making a still closer union of its particles.

ELECTRIC LIGHT AND WATER-WORKS PLANT AT HOLLAND, MICH.

Operating Features and Statistical Data of a Municipal Combination System.

LACK of good business management and insufficient records are often painfully evident in private electric lighting companies and have been frequently commented upon. Municipal enterprises have a reputation among the electrical fraternity for even worse lack of system and competent management; and, in spite of all their shortcomings, the private companies usually average up better than the municipal plants. A few notable exceptions have been found among municipal plants and described at length in these columns. It is pleasant to be able to describe another notably successful and well-managed plant of this kind, that at Holland, Mich. The success of this plant, although largely due to management, can also be partially attributed to the fact that the water works and electric light plant are operated together, with certain economical advantages which would not obtain with independent operation. While the results quoted in this article may not be within the reach of other plants of similar size giving only one kind of service, they will be of much interest to the numerous central-station companies which at present operate a water-works system, or which have under consideration the electrical operation of municipally owned water works in their respective cities.

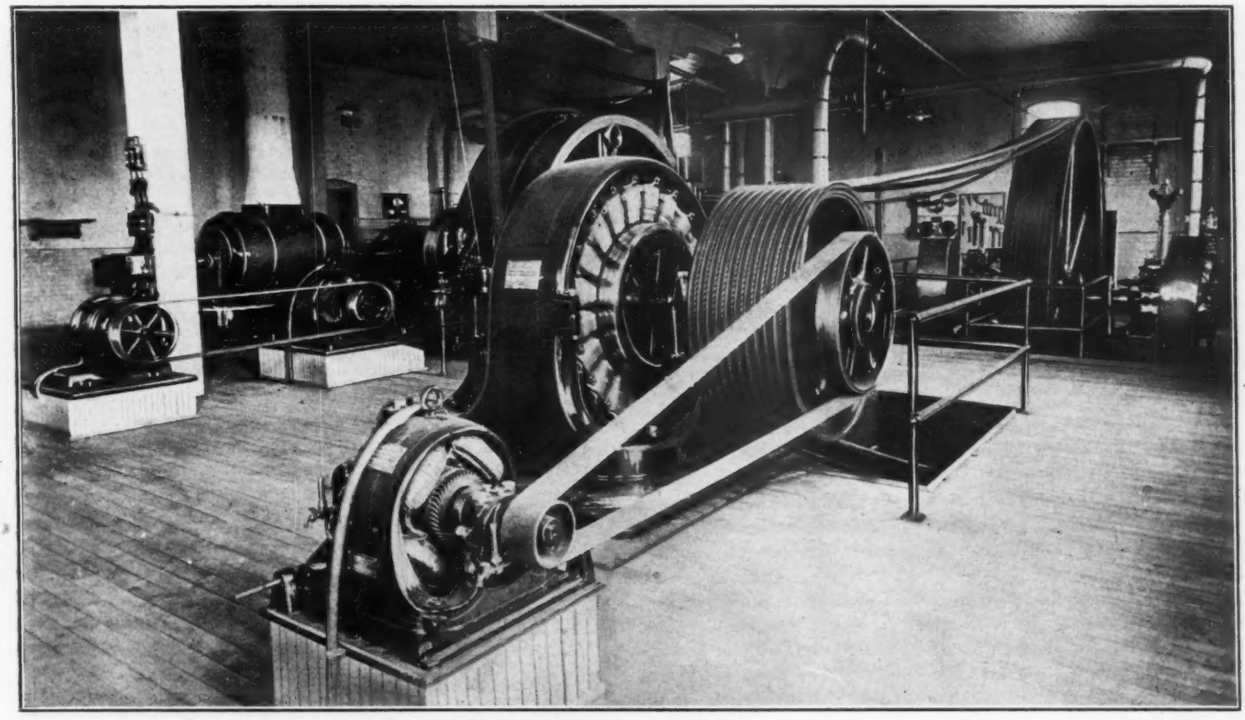


Fig. 1—General View of Engine-Room.

EQUIPMENT.

Before discussing the results obtained, a brief description of the equipment used will be necessary. The plant serves a city of about 10,000 inhabitants located at the head of a bay along the eastern shore of Lake Michigan. The operation is entirely by steam, and plenty of water is available for condensing. The station is located about 400 ft. from the Black River, with a lift of water from the river of about 17 ft. Condensing water is obtained through a 30-in. reinforced-concrete pipe line, 330 ft. long, and an open concrete canal at the river end, 70 ft. long. This pipe line discharges into a cold well at the power plant, which is 25 ft. deep and 12 ft. in diameter. The depth of water in the well varies from 4 ft. to 7 ft. This well and pipe line were put in by the superintendent of public works, using day labor. The excavation was entirely in sand, with quicksand below 11 ft., and the cost of the entire job was $4,474.74. Tools and appliances left over from the job were valued at $782.85 and were available for other work of the city.

Coal is obtained from a railroad siding, and in 1910 a rather unusual arrangement was put in for coal handling. This is shown in Fig. 2. A concrete coal bin holding 1100 tons was built mainly underground a short distance from the boiler-room. The railroad tracks run over the center of the bin and the tracks are supported on plate girders so that the cars dump the fuel directly into the bin, from which it is hoisted in small cars up an incline with an electric motor into the boiler-room, where it is weighed. It cost formerly 25 cents a ton to haul coal from the railroad yard to the power plant.

There are three generating units. The largest of these is a 500-kw Allis-Chalmers turbo-generator; the next in size is a Russell condensing engine direct-connected to a 300-kw Westinghouse generator, and the smallest is a Corliss condensing engine, connected with rope drive to a 125-kw Westinghouse generator. All generators are 2300-volt, 60-cycle, two-phase machines. There are three exciters, arranged to operate in parallel: A 15-kw direct-connected set; an 11-kw unit belt-driven from a motor with emergency belt drive from one of the generators and a 3.75-kw unit belted to the smallest generator.

The switchboard consists of three generator panels, three exciter panels, one totalizing panel, four single-phase panels controlling lamp circuits, three two-phase panels controlling motor circuits and two two-circuit panels for the arc-lamp circuits. There is a watt-hour meter on each generator panel and also one on the totalizing panels, so that the totalizing meter affords a continuous check of the generator meters. Graphic recording wattmeters and voltmeter are also part of the totalizing panel equipment. A Tirrill regulator maintains the generator voltage constant and the voltage of the different feeders is further regulated by Westinghouse hand-operated, single-phase, step-type, potential regulators. The insulation of all the wire on the switchboard is slow-burning and the supports for the overhead wires back of the board are made of ¾-in. iron pipes.

On the outside overhead system the ordinary practice is to run a three-wire secondary with grounded neutral through an alley with all the houses on the north side of the alley on the north pair of wires and those on the south side on the south pair. The general plan is to run the secondary line east and west in the alleys and the primary lines north and south on the street with the transformer at intersections. The street-lighting system comprises 155 6.6-amp series inclosed-arc lamps. All

Fig. 2—Concrete Coal Bins.

electric circuits are metered. The city owns a total of 1750 meters, of which 500 are of the old commutator type and the remainder of modern induction type.

One of the features about the system is the comparatively large motor load carried. At the close of the last fiscal year the connected horse-power in motors was 909. Part of the water-works pumping is done by a steam pump at the power station, but most of the pumping is done by a large electrically driven triplex pump of 3,000,000-gal. daily capacity located in another part of town where a better water supply is available.

NOTES ON OPERATION.

The 500-kw steam turbine is run most of the time, even for light loads, because its economy on the light loads is found to be better than that of the condensing Corliss engine. The full-load steam-economy test made on this turbine unit soon after it was started in February, 1909, showed a steam consumption of 20.9 lb. of dry steam per kw-hour with a vacuum of 26.75 in. The vacuum has since been increased to 27.5 in.

In cleaning boilers an unusually long time is allowed between the time a boiler is cut out of service and the time it is cut in again. When a boiler is shut down it is allowed to cool for two weeks with 8 qt. of solid soda ash in the water. This softens the scale so that it is easily removed and obviates all trouble from this source.

The power-plant operating force consists of nine men working on three shifts. This includes, however, one man at the Nineteenth Street pumping station, where the electric motor operates the triplex pump. The line work is done by three linemen, with occasional assistance from a fourth man. The city does not do interior wiring. An account of all material on hand is kept by means of a perpetual inventory, on which the number of articles or pounds of wire is kept constantly posted up to date by the meter inspector. Material taken out for a job is entered on this sheet, but the amount used is not entered until the unused part is returned.

It has been the policy for a number of years past to give free lamp renewals. Gem lamps are furnished on the free-renewal contract in sizes down to 8 cp, below which carbon lamps are supplied. Tungsten lamps are sold at about cost and nearly all the stores in town are using tungsten lamps. Blackened and burned-out tungsten lamps are exchanged by the lamp trimmer and prismatic glass reflectors, cleaned by the man who trims the street arc lamps, are loaned free to consumers in stores. The cost of carbon-lamp renewals is 0.0063 cent per kw-hour.

Testing and correcting of meters is carefully looked after, as is shown by the remarkably low percentage of lost and unaccounted-for energy for the last fiscal year. This was only 15.1 per cent for the entire system. This percentage is so low as almost to excite suspicion as to the accuracy of the switchboard output meters upon which it is based. However, since the output is metered both by the totalizing meter on the switchboard and by the meters on each panel, as before described, and as these meters act as a check on each other, the probability that the low line loss is caused by slow meters at the station is extremely remote. The low percentage of lost and unaccounted-for energy is probably due in part to the large amount of energy sold through meters for motor purposes. Since these meters have to register a smaller proportion of their output at very light loads than do lighting service meters the effect is to reduce the total amount of lost and unaccounted-for energy. Of course, the figure given of 15.1 per cent could not be attained without a thorough system of checking the accuracy of consumers' meters and looking after line and transformer losses carefully.

The lost and unaccounted-for energy for different classes of service for the last fiscal year was 21.5 per cent on lamp circuits, 11.2 per cent on motor circuits, 15.8 per cent on street arc circuits, or 15.1 per cent for the system. The total amount of energy registered on consumers' meters for the year was divided as follows: Lamps, 30.3 per cent of total; motors, 60.2 per cent of total, and street arcs, 9.5 per cent of total. It should be explained that the lost and unaccounted-for energy for the street arc circuit was based on the assumption that each arc lamp took 450 watts.

Testing and changing meters requires all of the time of one man and part of the time of another. From March 16 to July 31, 1910, 700 meters were tested at a total cost for labor of $284.74, or 40.6 cents per meter. Of this amount $75.15 was for the work of changing meters. The labor cost of repairing meters, which is kept separate, was $10.39 during this period.

During the fiscal year ended March 15, 1910, 1220 meters were tested at a cost of 45.5 cents per meter. A 4-in. x 6-in. card record is kept of each meter, giving the city's number, the maker, maker's number, when received, amperes, volts, type, number of wires, number of phases, constant and calibration constant. Under the heading are given the date on which the meter was set, the meter-book index, the name and address of the customer and the date the meter was removed or cut out. On the back are given a blank to record the date tested, the test load in watts, the error found and the repairs made and their cost. The commutator-type meters are brought in to the city shop for testing, while the induction-type meters are tested on the consumers' premises. For testing on consumers' premises there are two portable rotating standard meters in use, one of

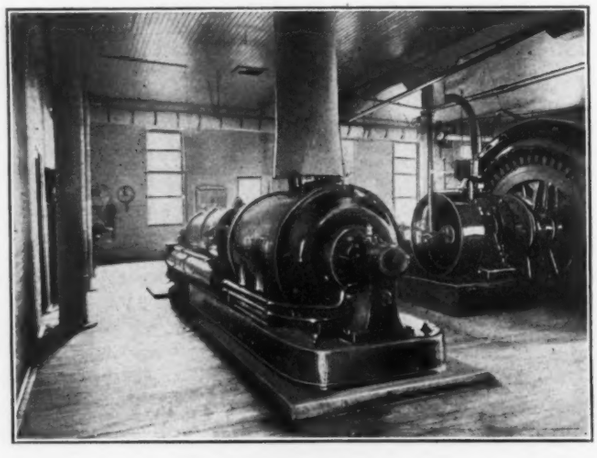


Fig. 3—Turbine.

General Electric and one of Westinghouse manufacture. It is the general policy to test the commutator-type watt-hour meters once a year and the induction meters every one and one-half or two years. During the twelve months ended Feb. 28, 1910, 1220 meters were tested. Of these 829 were found within 3 per cent of accurate, 154 were within 91 per cent to 96 per cent accurate, ninety-three were between 104 per cent and 109 per cent accurate, sixty-three were between 81 per cent and 90 per cent, twenty-seven were between 110 per cent and 119 per cent,

fifty-one were 80 per cent or lower and three were 120 per cent and higher.

The work of meter reading is divided into nine routes, to cover each requiring approximately a day's work. Four men read two routes each and one reads one route. The accounts on the consumers' ledgers are kept in the same order as the meter routes, so that billing can be done directly from the meter readers' books without turning ledger pages more than one at a time. As new customers are added they are given decimal numbers in between those of the older consumers. An alphabetical index of consumers enables the accounts to be located by number.

The thirty-two transformers on motor circuits aggregate 546 kw. These take care of about 750 hp in motors. The 150-hp motor on the 3,000,000-gal. triplex pump is operated without transformers at 2300 volts. There are forty-two transformers on lamp circuits with a total rating of 401 kw, which supply a connected lighting load of 1474 kw. The connected load in kilowatts as given in the last annual report is summarized as follows:

	Kilowatts.
2-cp lamps	3.8
4-cp lamps	6
8-cp lamps	70
16-cp lamps	1236
32-cp lamps	42
No. 3 Gem lamps	19
No. 4 Gem lamps	16
No. 5 Gem lamps	23
Miscellaneous Nernst lamps, meridian and tantalum	11
25-watt tungsten	2
40-watt tungsten	9.6
60-watt tungsten	5
100-watt tungsten	10
150-watt tungsten	5.3
250-watt tungsten	5.2
11.4-volt tungsten series multiple lamps	9.6
Total connected lighting load	1474.2
Commercial arc lamps	22.4
Two-phase motors	678.1
Street arcs	82
Single-phase motors	13.4
Heating devices, etc.	14
Electric flatirons	227
Total connected load	2522.1
Rating of plant	925
Maximum load for the year	730

The output of the plant for four years is shown in Fig. 5.

The watt-hours per 1000 gal. of water pumped at the city's Nineteenth Street station averaged 580 for the last fiscal year. In this no allowance was made for pump slippage, the amount pumped being calculated according to the pump displacement. The average head against which the pump operated was 150 ft.

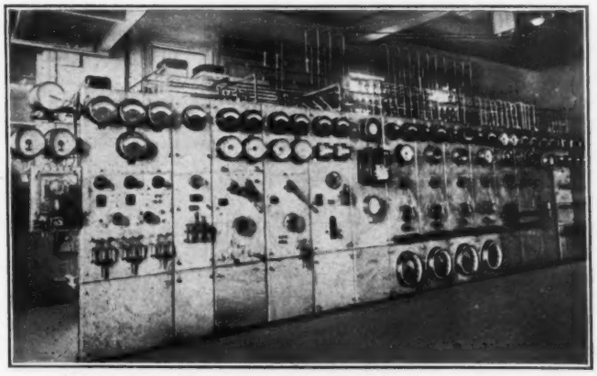


Fig. 4—Switchboard.

The city supplies electricity for lighting arches of tungsten lamps over two of the principal business streets. On Eighth Street there are twelve arches, twenty lamps to the arch, using a span-wire construction, as shown in Fig. 6. The lamps are 32-cp, 3.2-amp, 40-watt tungstens requiring about 11.4 volts each and operated twenty in series across the 220-volt secondary mains. The span wire is stretched from building to building and below this on links is suspended the electrical conductor from which the lamps are dropped. The lamps can be pulled to one side of the street for renewal, a scheme offering economical advantages over a tower wagon, especially in a small town. The merchants pay for the construction of these arches and also pay the city $62.50 per arch of twenty lamps per year. The city supplies the lamp renewals free. The drop wire supporting these lamps is No. 12 stranded. No. 14 solid was formerly used, but gave trouble. These arches are operated until 11 o'clock each night except Saturday, when they are operated until midnight. The Cutter street series socket is used.

The total cost of labor and material for installing the twelve arches on Eighth Street was $427.21, of which $138 was for labor and $339.21 for materials.

FINANCES.

Figuring the results of this plant according to the standard central-station facts and factors adopted in tables heretofore published in the *Electrical World*, the following results are obtained:

TABLE OF FACTS AND FACTORS.

Rated capacity of stations	925 kw
Total population of district served	10,000
Total liabilities per kilowatt of station capacity	$74.50
Gross yearly income per kilowatt of station capacity	$66.60
Gross yearly income per $100 liabilities	$89.40
Per cent of yearly income spent for operation, including everything but interest and depreciation	50.7
Yearly operating expense per $100 liabilities	$46.70
Total connected load in kilowatts per kilowatt of station capacity	2.7
Connected kilowatt load in lamps per kilowatt of station capacity.	1.5
Connected kilowatt load in motors per kilowatt of station capacity	0.7475
Connected kilowatt load in heating apparatus per kilowatt of station capacity	0.271
Kw-hours sold or accounted for, per 100 kw-hours generated	84.9
Kilowatt transformer capacity per kilowatt of station capacity	1.02
Kilowatt transformer capacity per kilowatt of connected load	3.75
Kilowatt station capacity per employee, all departments	40
Yearly load-factor in per cent	26.3
Gross yearly income per capita of population	$6.16
Liabilities per capita	$6.90
Watts station capacity per capita	92.5
Number of consumers per 100 of population	16.4
Number of residence consumers per 100 of population	15.4

These figures show an unusually high development of the territory served, which is especially remarkable for a municipally owned plant.

The revenues and expenditures of the electric plant for the fiscal year ended March 21, 1910, were as follows:

ELECTRIC LIGHT REVENUES AND EXPENDITURES.

Revenue:	
Receipts for current	$52,606.66
Arc lighting at $50 per year per lamp	6,800.00
Sale of material, etc	1,930.33
Public incandescent lighting	150.72
Difference in inventory	126.94
Total	$61,614.65
Expenditures:	
Operating expenses	$32,218.67
Interest on bonded indebtedness of $69,000	3,242.50
Estimated taxes the plant would pay if owned by a private corporation	1,000.00
Depreciation of plant	9,329.56
Total	$45,790.73
Profit	15,823.92

Disbursements for permanent improvements during the year amounted to $16,403.30.

Although the electric and water plants are operated together, the expenditures in each are separated on the books as far as possible. However, in order to form an intelligent opinion of the plant as a whole a brief statement of the condition of the water system financially will be given. The revenues and

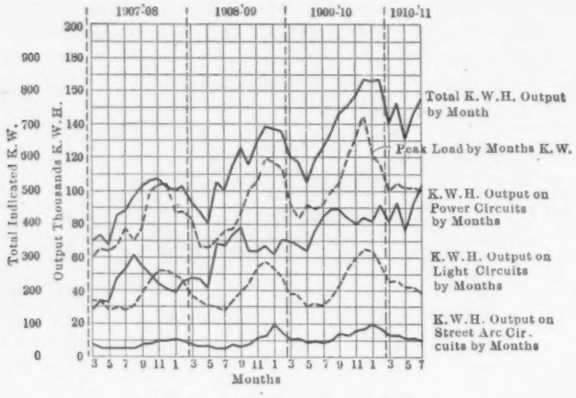


Fig. 5—Output Curves by Months.

expenses of the water works for the fiscal year before mentioned were as follows:

WATER-WORKS REVENUES AND EXPENDITURES.

Revenue:	
Receipts from consumers	$14,707.00
Hydrant service, charging the city with $35 per year per hydrant	8,610.00
Difference in inventory	47.61
Total	$23,364.61
Expenditures:	
Operating expenses	$12,952.95
Interest on bonded indebtedness of $64,000	3,010.00
Estimated taxes the plant would pay if owned by a private corporation	1,000.00
Depreciation of plant	4,593.83
Total	$21,556.78

Fig. 6—Arch-Span Construction.

The value of the water-works plant at the end of the fiscal year, after taking off depreciation amounting to $4,593.83, was $136,618.22.

Depreciation is estimated on different portions of the plant as follows: Land, 0; buildings, 8 per cent; meters, 7 per cent; station equipment, 6 per cent; distribution system, 10 per cent. The total value of the electric plant, March 21, 1910, after taking out the foregoing percentages for depreciation on the value of the plant the year previous, was $116,076.41.

For a number of years previous to Sept. 1, 1910, this plant has been in the charge of Mr. James De Young, superintendent of public works. Upon his resignation, Sept. 1, to enter the employ of a syndicate controlling a number of large plants in Michigan, Mr. R. B. Champion, formerly clerk, became acting superintendent.

OIL-FUEL GENERATING STATION AND 1200-VOLT DIRECT-CURRENT SUBSTATION AT FRUITVALE, CAL.

IN connection with the installation of a 1200-volt, direct-current railway system on the Oakland, Alameda & Berkeley suburban lines the Southern Pacific Company has erected at Fruitvale, Cal., a combined generating and distributing station that possesses a number of features of interest.

The fuel employed is California crude oil, which is much cheaper than coal. However, the boilers have been so designed that in case it should be found desirable to burn coal stokers or grates can be installed at both ends of the boilers. In the basement provision has been made for coal-handling machinery that may be required. The building and steel work

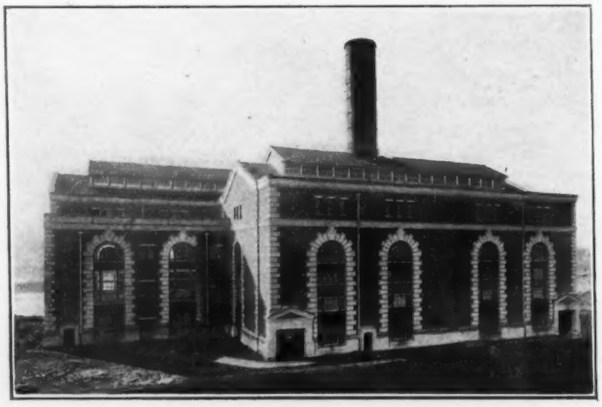


Fig. 1—Power House from the North.

are so arranged that automatic coal-handling and ash-handling apparatus can be installed.

The boiler-room has been designed for sixteen 645-hp boilers, twelve of which have been installed. These are of the self-cleaning type, because they deposit the scale in a pocket in the drum instead of in the tubes. Three oil burners are placed in front of each boiler. The stack, which has been arranged for oil firing with natural draft, is of unlined steel 125 ft. high and 14.5 ft. in diameter.

The main station has been arranged for four generating units, two of which have been installed. These are Westinghouse double-flow turbo-generators rated at 5000 kw continuous load, 7500 kw for two hours or 10,000 kw for one minute. They are three-phase, 25-cycle machines wound for 13,200 volts at a speed of 1500 r.p.m. The guaranteed steam consumption is not over 15.9 lb. per kw-hour, with 175 lb. gage pressure, 150 deg. Fahr. super-temperature and 28-in. vacuum. The generators are cooled by forced ventilation, the air being taken from outside the station through screened galvanized-iron ducts in good weather and from the turbine-room basement in foggy or damp weather.

Mounted on the end of each turbo-generator shaft is a 125-kw direct-current generator which supplies energy for the field circuit of the generator and the lamp circuits around the station. For insuring a continuous supply of energy for excitation and station lighting use is made of a 136-cell battery

furnished by the Electric Storage Battery Company and a 125-kw General Electric steam-turbo-generator exciter set.

Four substations receive energy from the main 13,200-volt, three-phase system. One substation is at Berkeley, one at West Oakland, one at West Alameda and one at Fruitvale. The last-mentioned substation is housed in the same building with the main generating equipment. The present installation consists of three General El ric 1500-kw transformers and synchronous converter units, with space for three additional units. Each converter unit delivers direct-current energy at 1200 volts. The unit consists of two 600-volt converters with commutators joined permanently in series; the two converters are mounted on a common base and with shafts carried in a common center bearing, but free to revolve independently of each other. The converters are started from the collector-ring end at one-third and two-thirds voltage, obtained from taps on the transformers through triple-pole, double-throw oil switches. The operating handles of these switches and the full-voltage oil switches,

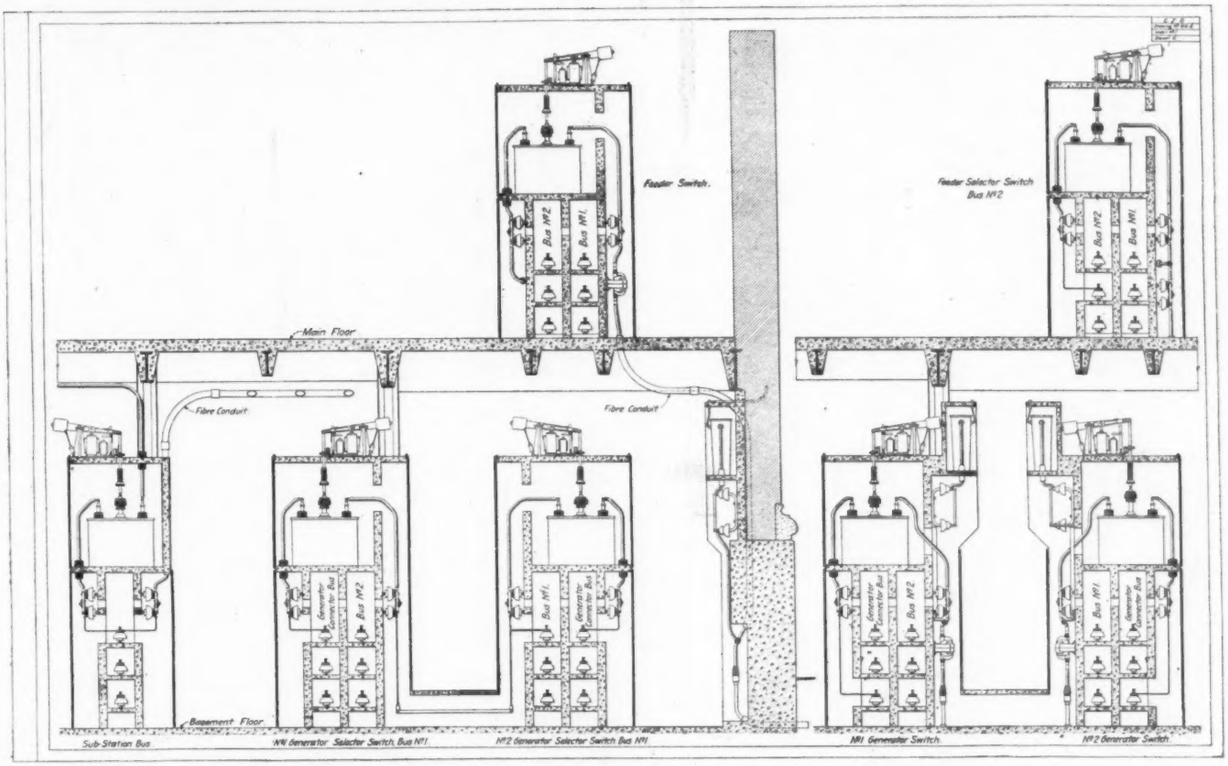


Fig. 2—Cross-Section of Switch Galleries.

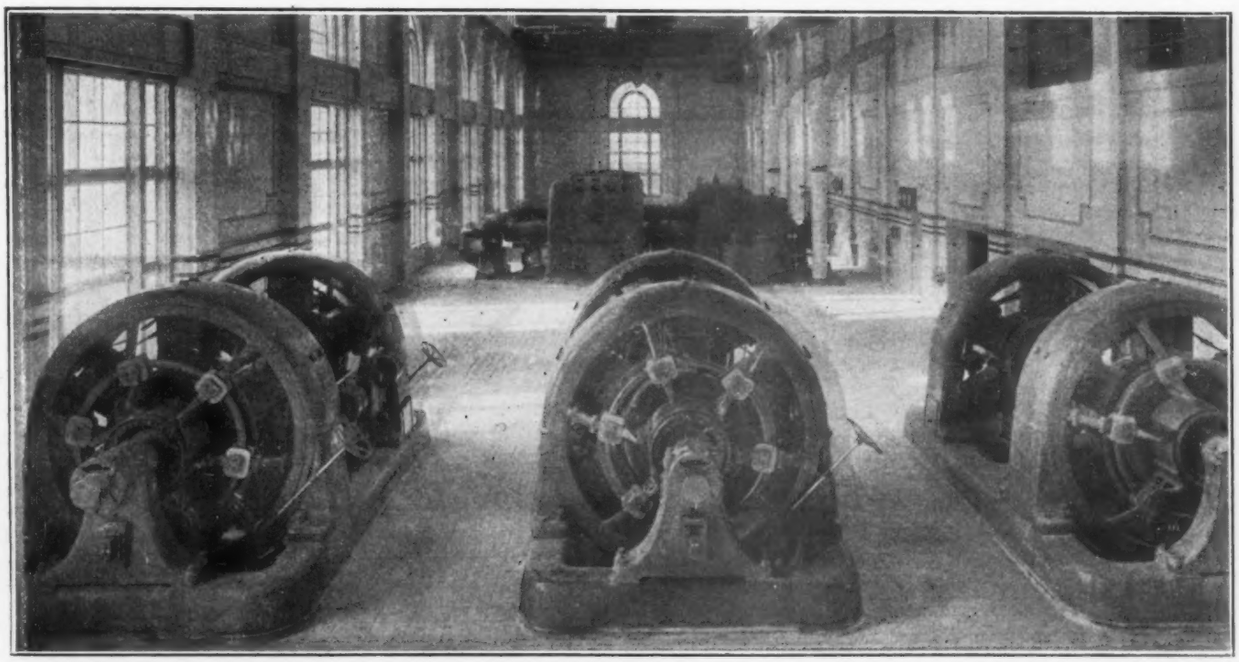


Fig. 3—View of Generating Room.

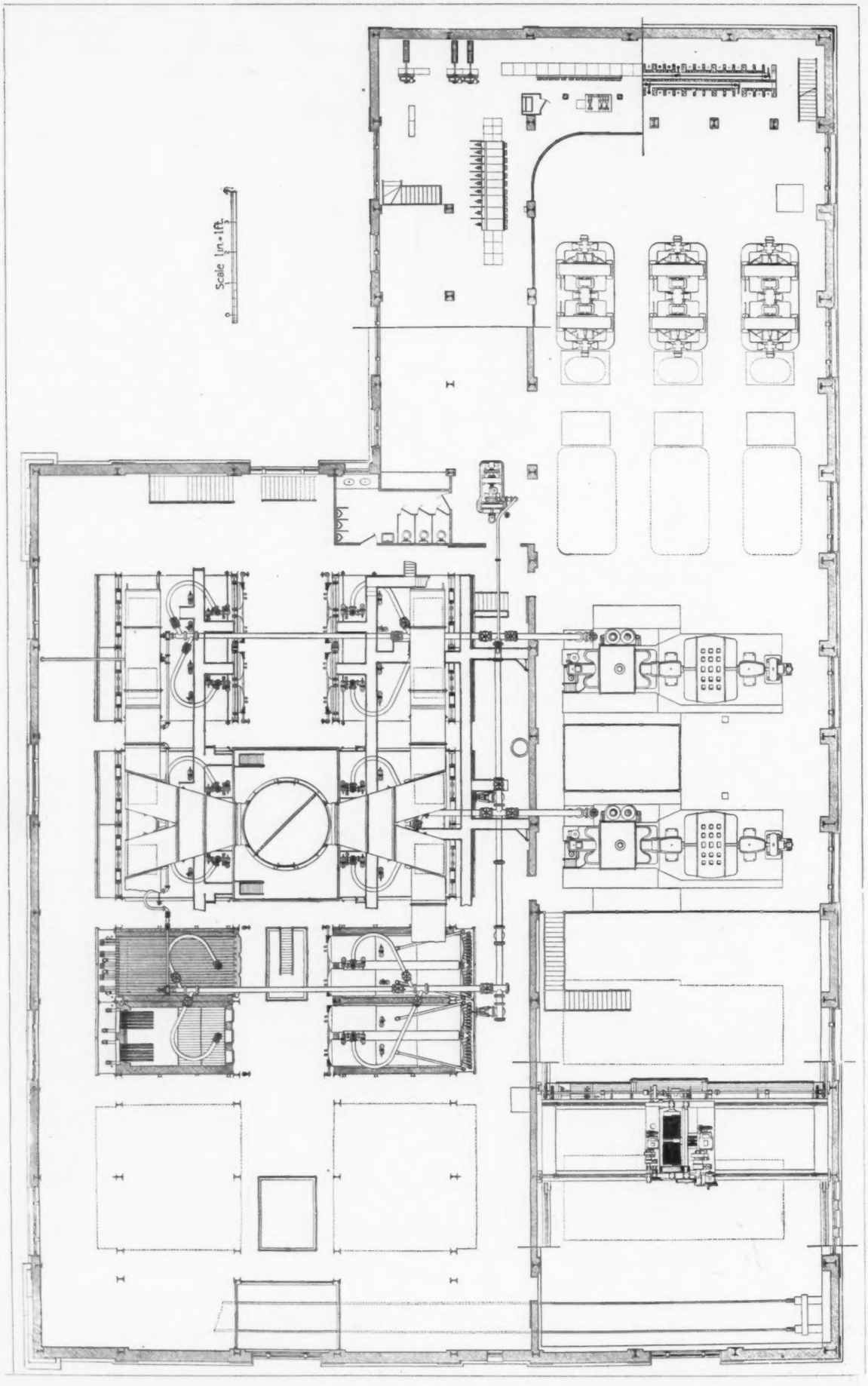


Fig. 4—Plan of Station.

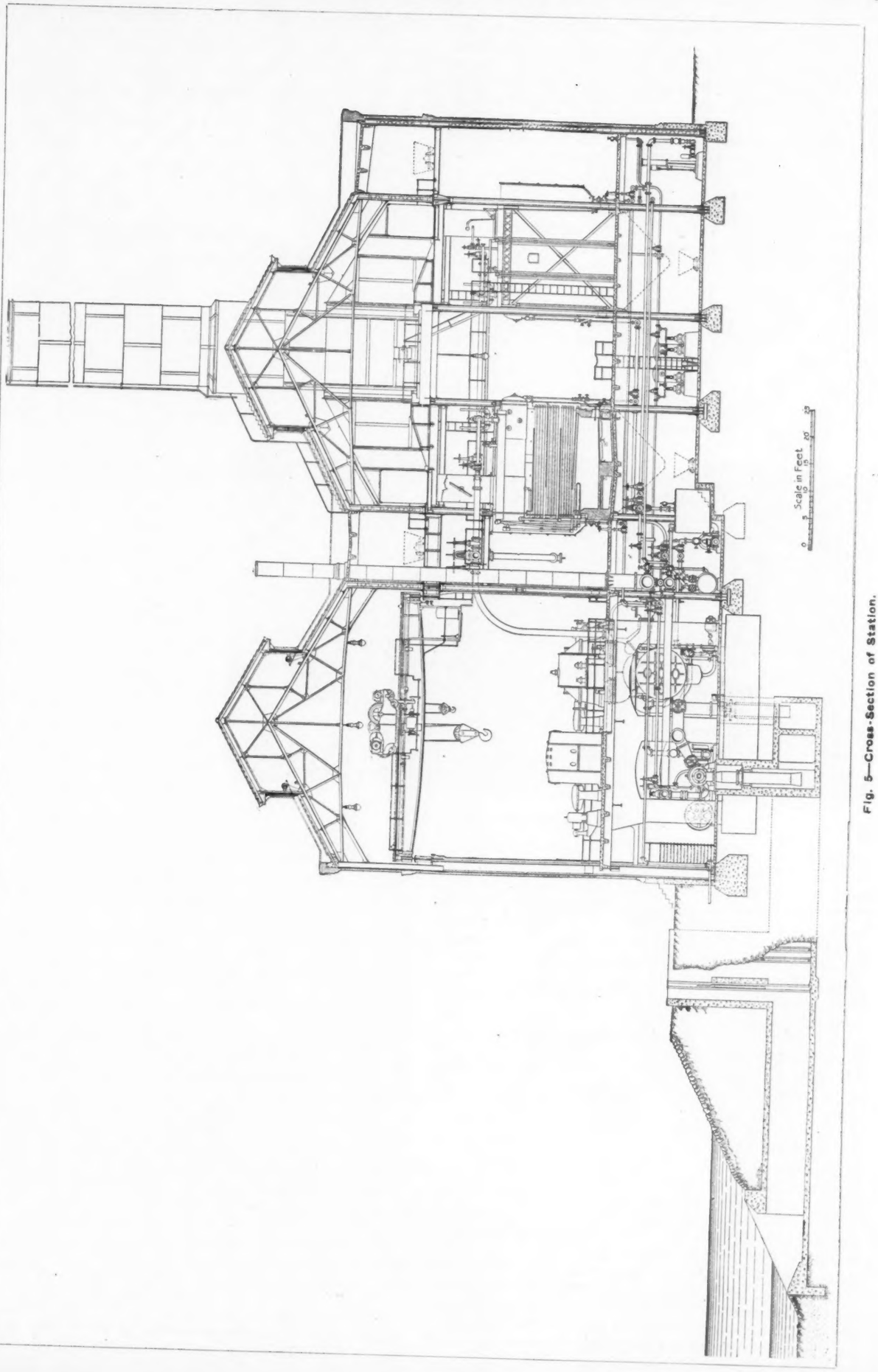


Fig. 5—Cross-Section of Station.

together with the field circuit break-up switches, negative and equalizer switches and polarity indicators, are mounted on slate panels attached to the converter bases. These bases are of cast iron mounted on oak insulating frames and, to limit insulation strains and to protect operators, the bases are connected through a resistance of 10 ohms to the 600-volt interconnection between the two halves of the unit. Additional protection is afforded the operator by the installation of tile insulated floor in the substation.

The switchboard is in two sections, one for the 13,200-volt generating equipment and the other for the 1200-volt distributing system. The two are located at the east end of the turbine-room on a gallery, the sections being placed at right angles to each other at the corner of the gallery. The generating section consists of a benchboard, instrument board and exciter and auxiliary boards. The 1200-volt board consists of front and rear panels 4 ft. apart. All switches and circuit-breakers are mounted on the rear panels and are of the remote-control, hand-operated type. The front panels contain the instruments and switch-operating levers. Spare rotary and spare feeder breakers are provided, with their switches connected to the spare breaker buses mechanically interlocked so that only one rotary or feeder at a time can be connected to its respective spare breaker bus. While the angle-iron frames of the front and rear panels are insulated from ground and from each other, the station will be operated with the front frame grounded and the rear frame insulated. Soapstone slabs are placed across the top bracing between the front and the rear panels. The 1200-volt bus is carried in a fireproof compartment above the soapstone slabs. The rotary rheostats are mounted on the soapstone slabs above the panels. A Thomson watt-hour meter and a Westinghouse recording wattmeter are installed to measure the total output of the substation. The entire switchboard was furnished by the Westinghouse Electric & Manufacturing Company.

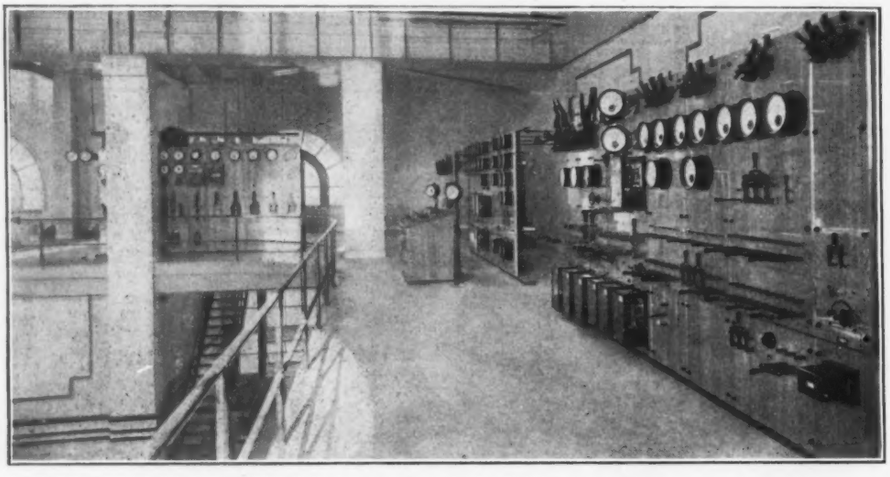


Fig. 6—Switchboard Room, South End of Gallery.

Arrangements have been made for obtaining a small supply of energy from the 60-cycle system of the Great Western Power Company. There has, therefore, been installed temporarily on one of the unused generator foundations a 2500-kw frequency changer, consisting of an 11-000-volt, 60-cycle synchronous motor driving a 13,200-volt, 25-cycle generator. A zero-center scale-recording wattmeter shows the instantaneous output from or input to the 25-cycle machine.

The above-described installation was designed, planned and specified under the direction of Mr. A. H. Babcock, electrical engineer of the Harriman lines, by Messrs. W. C. Miller, J. C. Lathroy and H. Y. Hall. The construction details were under the direction of Mr. J. Q. Barlow, assistant chief engineer, who had for his representative in the field Mr. R. T. Guppy, engineer of suburban lines, and for his architect Mr. D. J. Patterson, who was responsible for the artistic superstructure, which was built of ordinary and inexpensive materials.

A PORTABLE ELECTRIC GENERATING PLANT.

By F. W. Thompson.

THE portable outfit shown herewith was designed to furnish electric energy for light power work in building operations, especially in locations where there is no electric service, or where the cost of installing such a service would be out of proportion to the value of the work to be done. The unit, which is entirely self-contained, is mounted on a specially constructed truck drawn by two horses, making the plant strictly portable.

Cables are run from a terminal board over the driver's seat into a building, for instance, and connected up to such electric tools as are ordinarily used in building construction. Ample room is provided on the truck for carrying these tools to the job.

The generating plant consists of a 15 hp twin-cylinder, gasoline engine directly coupled up to a 7½-kw, 125-volt, 500-r.p.m. direct-current generator and mounted on a common sub-base. This sub-base is mounted on specially provided stringers built into the truck and so placed that the engine thrust comes directly over the rear axle. The whole revolving member is carefully balanced. The water-cooling tank is suspended underneath the truck between the front and rear axles and when full weighs approximately 1500 lb. This acts as a counter-balance for what little vibration there is when the generator is in operation. Practice has shown that there is so little vibration that it is unnecessary to block up the truck or the wheels even when the load is constantly varying from zero to full load, as in hoisting.

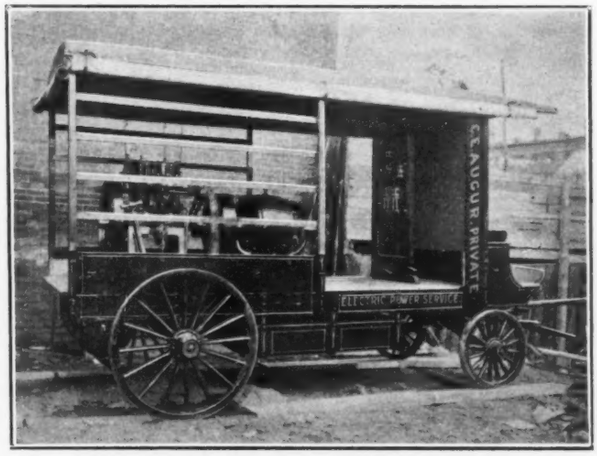
The engine is provided with a specially designed governor to take care of quick changes in load, and the generator shaft has a heavy balance wheel in addition to the engine flywheel.

The switchboard is mounted on springs to take up vibration and protect all delicate parts from jar when traveling, as the truck itself has no springs. Cables are run from the generator through conduit to the main switch on the switchboard. Four circuit switches are provided and connect through cables to a terminal board over the driver's seat. The field regulator and combination voltmeter and ammeter are also mounted on the switchboard as well as the ignition-control system for the engine. A double-throw switch is provided, so that either dry cells or a storage battery may be used for ignition purposes, the latter being charged from the plant.

Provision is made for an exploring lamp and an outside red lamp as a signal when the plant is not running and is standing in the street at night. Both of these lamps are fed from the storage battery.

Underneath the truck is a 180-gal. water-cooling tank piped to two circulating pumps mounted on the engine, which force the water through the engine jackets and return it to the tank for cooling. To the rear of this tank is a double-muffler arrangement, which assures quiet operation under heavy loads. Back of the rear axle is suspended a 40-gal. fuel tank and alongside of this is a smaller tank for compressed air. Both tanks are piped to a hand air pump and air-pressure gage mounted inside the truck next the engine. The fuel-supply pipe is taken out of the top of the fuel tank and leads directly to the carburetor on the engine. On account of using an auxiliary air tank it is only necessary to give the air pump a few strokes in a day's run to make up for the increased volume in the fuel tank due to the consumption of fuel.

When the plant is shut down the air valve is closed and a relief valve opened, which relieves the pressure in the fuel tank, and what gasoline remains in the fuel pipe drains back into the tank. This also assures no loss of gasoline should a connection become loose when the portable outfit is being moved. The fuel tank is provided with a gage above the floor of the truck, showing at all times the amount of fuel in the tank. There is a gasketed and capped hole in the top of the



Portable Generating Station.

fuel tank for filling, which is reached through an opening in the floor provided with a deck plate. The air tank, pressure gage, piping and valves are made to withstand 30-lb. pressure to the square inch. Provision is made for attaching an air hose so that this compressed air can be used for blowing out accumulations of dust around the engine, generator and switchboard.

Under the driver's seat space is provided for tools, lubricating oil, waste, etc. The floor space around the engine and generator and part way up the side boards is covered with zinc to keep oil from soaking into the woodwork, thus reducing the chances of a serious fire should any of the gasoline escape and by chance ignite. The truck is also provided with chemical fire extinguishers of a type specially designed to put out a gasoline fire. Side curtains of heavy sail canvas and made to roll up are provided for the two sides and rear. These are thoroughly painted, and when down are tightly strapped in place. This allows the operation of the plant in all kinds of weather. After several months' exposure to outdoor weather there has not been the slightest trouble with the operation of the plant.

There are two 16-cp lamps hung from the ceiling, one over the engine and the other over the generator, besides a pilot lamp on the switchboard. These give ample light when the curtains are down or when operating at night. While the plant was designed for motor work, it gives remarkably steady voltage when motors and lamps are operating, and there is no flickering whatsoever on a straight lighting load.

At the outset it was intended to develop a thoroughly self-contained electric generating plant on wheels, and service has shown that the idea has been fully realized. Electricity can be provided on any building operation just as soon after the arrival of the outfit as the water tank can be filled up. This, with a hose, requires less than ten minutes' time. The total weight of the plant, without water in the cooling tank, is less than three tons. One horse can easily handle it on level city pavements, but it is arranged for two horses when traveling any considerable distance. It has been drawn over twenty miles of rough country roads without the slightest damage to any of its parts. The outfit was designed and built under the personal supervision of the writer, who is an electrical constructing engineer of New Haven, Conn., for Mr. Charles E. Augur, a building contractor of the same city.

FELLING TREES BY ELECTRICITY.

By Albert Scheible.

ONE of the most notable tendencies of the past year toward the wider utilization of electric energy has been found in the so-called "overland central stations" of Germany, stations with circuits running to other towns over fertile farm lands which can furnish a desirable day load. But while the use of electricity has thus been extended even to driving plows over fields of wide expanse, the forests have so far been untouched. This is surprising, inasmuch as felling trees and trimming them to marketable logs means the need of power in a very congested area as compared with plowing and allied field operations. That the forests have been immune from inroads of electric progress is due to the common modes of felling trees, methods on which the march of the centuries has had hardly any effect and in which it has not seemed feasible to replace manual labor by electric motors. The woodman's axe still resounds through the forests, though every wasted chip now means the loss of much more valuable timber. The effective stroke of the axe from continually changing directions would require a complicated mechanism to reproduce it and one liable to serious damage if a tree should fall upon it. The same breakage risk would be met in any attempt to drive a saw by electricity, just as in the case of the steam-actuated tree-felling saws made for colonial use by English manufacturers. Besides, the sweep of a power-driven saw, like that of the ordinary double-handled saw of common practice, requires considerable space, thus prohibiting the use of any saw until one or more trees have been chopped down where they are closely bunched. The steam-driven tree saws also require a crew of men to operate each, besides a team for moving the plant about the forest, which moving demands a general trimming of the underbrush and a fairly dry soil. The fact that these steam saws are proving economical in spite of such difficulties shows that power cutting is needed and that there ought to be a field for a tree-feller with fewer handicaps.

Aside from chopping and sawing a third method of tree felling consists in burning through the base of the trunk. To

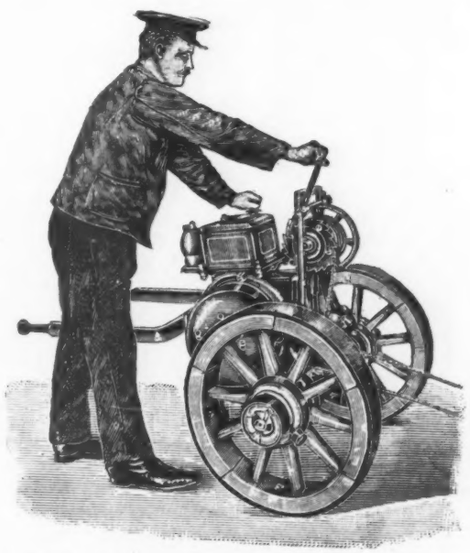


Fig. 1—The Gantke Machine for Felling Trees.

do this with a bonfire is at once slow, wasteful of timber and likely to cause a forest conflagration. Burning experiments were made a few years ago with a high-resistance wire heated by electricity and looped around a tree so as to burn its way through it. This proved too frail and costly for practice, though the trials showed that with such a method the trees could be cut much closer to the ground than with any of the older methods. Another disadvantage was that it required the

operator and the rheostat for controlling the supply to be close to the timber, thereby exposing both to danger from the falling trees.

More recently a German inventor, Mr. Hugo Gantke, has perfected another method of cutting timber by the use of a hot wire. The heat in this case is supplied not by the passage of a current of electricity, but by the friction of the wire on the tree itself. For this purpose a steel wire is looped tightly around the tree and pulled back and forth about 1500 times a minute by an electric motor. The cutting wire itself need only be a little longer than half the circumference of the tree, being coupled to steel strands which lead to the motor, thereby allowing the latter to be placed 100 ft. or even 150 ft. off. The cut can easily be started close to the earth (or, if desired, a trifle below the surface) so that, instead of the usual stumps which interfere with the transportation of the timber, no obstructions are left above the ground. This lowering of the cutting plane not only increases the length of the log obtained from any given tree, but also includes an added foot or two of the wide-spreading base, thereby enlarging the average diameter from which the lumber feet in the log are figured. The increase in the resulting quantity of lumber shows up favorably as compared with the primitive method, which wastes considerable of the length even above the remaining stump and which leaves the end of the trunk in a rough condition requiring further trimming. While such trimming of the ends is not needed where trees are sawed, the use of a saw requires a helper to follow the saw with wedges so as to avoid jamming it. With the hot-wire method no wedging is needed and the end of the log is charred so that it can be marked with crayons. The carbon coating also protects the cut ends against the action of the weather if the log is left lying on the ground for some weeks. Consequently the new method is said to increase the amount of lumber obtained, to avoid the expense of stump pulling, to decrease the cost of transporting the logs and to reduce the amount of rotting if the timber is not promptly moved.

The labor cost varies with the size and the hardness of the timber. Mr. Gantke's experiments have implied that the time

Fig. 2—The Gantke Machine in Operation.

required for cutting trees of a given size increases with the hardness of the wood in about the same ratio for his hot-wire method as for a double-ended saw in the hands of skilled workmen, the ratio being about 3.3 minutes for linden or ironwood and 1.8 minutes for beech or oak, in proportion to every minute needed for cutting pine of the same diameter. However, the required time does not increase nearly as fast for the friction-wire method as for hand-sawing with an increase in diameter of the same wood, even when no allowance is made for rests taken by the men in the midst of heavy cuts. Thus Mr. Gantke reports the cutting time for Scotch fir (which cuts about 6 per cent faster than pine) as follows:

Diameter of fir, inches.....	7.6	12	19.2
Minutes for hand sawing.....	1.5	4	12
Minutes for hot-wire cutting....	0.7	1.8	4.5

For beech similar tests showed this comparison:

Diameter of beech, inches.....	7.6	12	19.2	30
Minutes for hand sawing.....	2.7	6.9	18.9	120
Minutes for hot-wire cutting ...	1.3	3.4	8.5	20.8

In these comparisons it must be remembered that the hand-sawing required two men at the saw and for fair-sized trees a

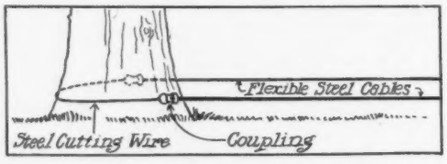


Fig. 3—Showing Cutting Wire and Cables.

third at the wedges, while the hot-wire method needs but one man to operate it even on the largest trees. This, minus rests which even experienced men take between cuts, means that the real difference in output per man would be tremendously in favor of the hot-wire method. For large trees it would appear from figures lately published in the *Timber Trades Journal*, of London, that the steam-driven tree saws will do even faster work per tree, but they require four men and a span of horses, besides leaving the objectionable stumps.

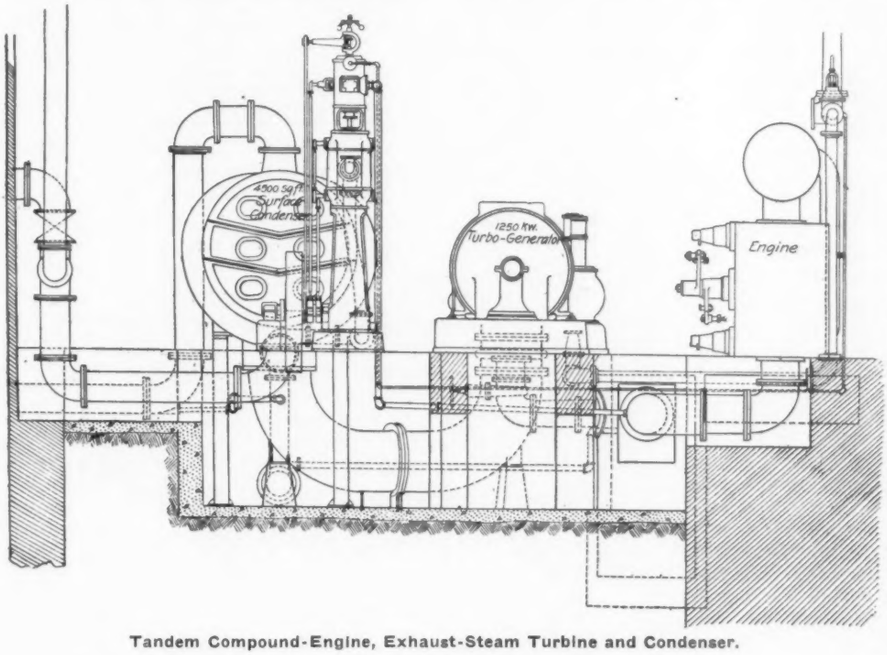
The Gantke machine, although mounted on a truck with wheels having wide tires, weighs only 550 lb. all told, the weight being so distributed as to anchor the truck against the pull of the cables when in operation. It can easily be moved from place to place by one man, and is said to be so simple that inexperienced help can readily operate it. After the cutting wire is looped around the tree and coupled to the steel cables the operator merely turns a crank with one hand to tighten the cables, while his other hand turns on the circuit. A new cutting wire is used for each tree of any fair size, the diameter and length of the steel wire used for this purpose being chosen to match the hardness and size of the tree to be cut. Of course, a large number of trees can usually be reached from a single location of the motor. The same device will also cut the felled trees to the desired marketable lengths, although the saving in time over hand-sawing is not so great with horizontal as with standing timber. In practice the motor truck is usually placed 100 ft. or 150 ft. from the trees to be cut, thus taking both the machine and the operator well out of the danger zone of the falling trees. Then, when the trees have been felled, the machine is brought close up for more conveniently replacing the friction wires when trimming the trees to the desired lengths.

The wires used sell in Germany for from 20 cents to $1.20 per 100, but Mr. Gantke claims that this expense for new wires is fully offset by the cost of sharpening axes or saws and of resetting the saws with the older methods. With European timber the power required for various woods ranges from 1½ hp to 7 hp. Where no source of electricity is accessible a portable outfit consisting of a 10-hp gasoline engine and dynamo mounted on a separate truck is used. Where virgin forests are to be cut a number of such wire-pulling electric motor outfits can be supplied from a single generator mounted on a steam-traction engine or (as suggested for some of the German colonies in Africa) on a steamer, in which case electricity could also be used in transporting the timber to the wharf.

CHANGE OF ENGINE-CYLINDER RATIO FOR EXHAUST-STEAM TURBINE OPERATION AT APPLETON, WIS.

To increase the output of a pair of nominally 1300-hp tandem-compound Corliss engines which formerly operated condensing and to permit their exhausting into two 1250-kw low-pressure steam turbines, the cylinder ratios of these engines in the Appleton (Wis.) plant of the Wisconsin Traction, Light, Heat & Power Company have been modified by increasing the area of the high-pressure cylinders 35 per cent. As operated condensing the cylinder dimensions were 19 in. x 40 in. x 36 in. The new high-pressure cylinders are 22 in. in diameter.

The Appleton power plant was built about nine years ago. At that time there were installed two generating sets, each consisting of a 500-kw railway direct-current generator and a 500-kw, 60-cycle, 300-volt alternator. These sets were driven on one end by Victor water turbines, utilizing the water-power of about 2400 hp at this point of the Fox River. On the opposite end of each generating unit there was connected through a clutch a tandem-compound Corliss engine without releasing gear. The hydraulic head is 17 ft., and it was concluded that the most economical turbines available should run at a speed of 150 r.p.m. On this account, in order to have the engines drive directly without belting, they were arranged without releasing gears. These engines were operated condensing, their cylinders being 19 in. x 40 in. x 36 in. To meet the changed conditions of operation with the exhaust-steam turbines the engines have recently been modified by changing their high-pressure cylinders. The new low-pressure turbines are 1250-kw Allis-Chalmers machines, operating at 3600 r.p.m., and driving 60-cycle, 2300-volt generators. It was desired to increase the capacity of the engines and also to reduce their cylinder ratio, both of which were necessarily affected by the change. The condensing equipment for this plant consists of two surface condensers of 4500 sq. ft. each, manufactured by the Fred M. Prescott Company, which has also furnished all pumping apparatus. No circulating pumps for the condensers are required, the difference in level between the head and tail waters being sufficient to produce the necessary circulation. The plant is equipped with four Stirling boilers each of 350 hp and equipped with Foster superheaters, raising the temperature 100 deg. above saturation at a pressure of 150 lb. per square inch. The reconstruction just described has been practically completed and tests will be made within a short time to show what results can be obtained with a composite plant of this kind.



Tandem Compound-Engine, Exhaust-Steam Turbine and Condenser.

KEROSENE AS A FUEL FOR INTERNAL-COMBUSTION ENGINES.

The advantages and the use of kerosene as a fuel for internal-combustion engines were discussed by Mr. G. H. Holley, of Detroit, Mich., in a paper before the National Gas and Gasoline Engine Trades Association convention at Racine, Wis., recently.

Pennsylvania petroleum, said Mr. Holley, contains 41 per cent to 45 per cent kerosene and only 15 per cent gasoline. The Western petroleums contain about 30 per cent kerosene and 15 per cent gasoline. This proportion in the natural crude oil explains why, in carload lots, kerosene may be purchased for 5 cents a gallon, while gasoline costs 10 cents and is rapidly rising in price.

The drawback to the use of kerosene is the difficulty encountered by the carburetor in volatilizing this heavier oil. For successful operation the carbureting action must take place with the oil heated to about 200 deg., usually by jacketing with the exhaust gases from the engine, and the kerosene vapor must be conveyed directly to the engine cylinders at high velocity.

The available energy in a gallon of kerosene is about 92 per cent of that in a gallon of gasoline. This relation has been shown both by laboratory calorimeter tests and by the actual performance of automobiles using the two fuels in internal-combustion engines. In the latter case a car ran thirty-four miles on a gallon of kerosene and thirty-eight miles on a gallon of gasoline.

For starting kerosene engines where the exhaust gases are used to heat the special carburetor it is found most practical to furnish an auxiliary gasoline tank and simple gasoline carburetor, starting up the engine as a gasoline engine. After a minute's operation the exhaust becomes sufficiently warmed to enable the engine to be thrown over onto the kerosene tank by means of a three-way valve.

Mr. Holley also referred to the practice of adding water to the kerosene to improve the carburetor action. Introducing 6 per cent to 8 per cent of water to the oil facilitates volatilization and does not interfere with the fuel value of the kerosene.

INFLUENCE OF LOAD-FACTOR ON COSTS.

In a paper on "Central-Station Economies" read at the recent convention of Byllesby companies in Chicago Mr. Eugene Holcomb, manager of the Northern Heating & Electric Company, of St. Paul, Minn., made some interesting remarks on load-factors in relation to the cost of producing electrical energy. He said that with a load-factor around 30 per cent fixed costs of water-power development can easily be more than the fuel and labor costs of an efficient steam plant. The fixed charges should not run to more than 7 mills or 8 mills per kw-

hour to compare favorably. Economy in the use of water-power comes only from the greatest load-factor. The influence of load-factor on costs, and consequently on rates, must in all cases be taken into account. The curves in Fig. 1 show the influence of load-factor on investment and operating costs. These curves show that in a plant costing $250 per kilowatt capacity the fixed costs alone, at 30 per cent load-factor, are a trifle higher than the total fixed and operating costs for a plant costing $125 per kilowatt capacity with coal at $2 per ton. These costs would be 1.15 cents and 1.1 cents respectively. It will be seen by increasing the load-factor of the $250 plant from 30 per cent to 60 per cent the total operating costs would about equal the costs for the $125 plant at 30 per cent load-factor.

Attention is called to the operating costs represented by the lines below the axis. In small plants, either hydraulic or fuel-burning, of, say, 3000 kw capacity or less, with, say, three units, the labor and general office expense is independent of

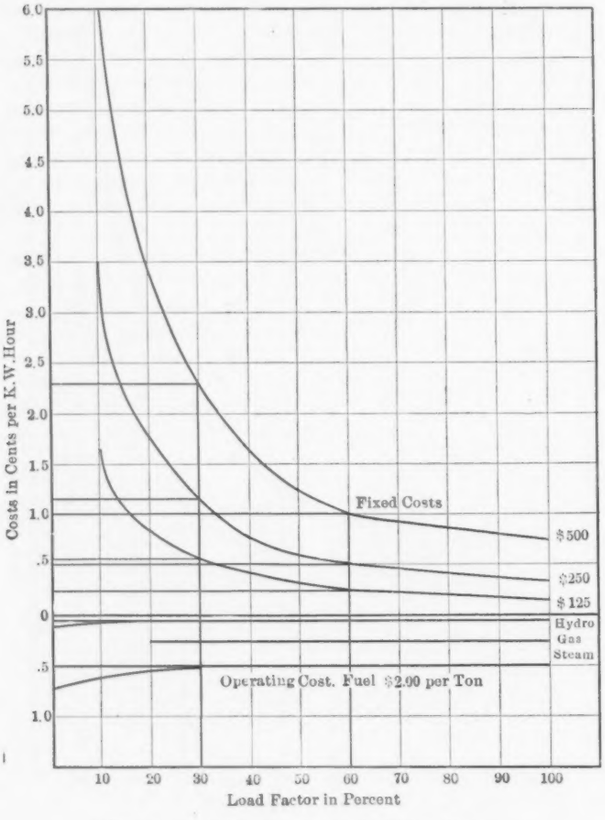


Fig. 1—Investment and Load Factor Curves.

load-factor. These items are practically constant the year round and have the same effect on total unit costs as the capital costs. To illustrate this point, refer to the curves in Fig. 2. This represents the conditions of one of the company's plants. The curve represents interest on capital and all other charges against operation except fuel, which is shown by the straight line below the axis. This is practically the only item which varies with the output. Total costs are obtained by adding the curve and the straight line together. Load-factor herein referred to is intended to mean percentage of output to full-load output.

In conclusion Mr. Holcomb said: "The things we most need for the manufacture and distribution of reliable service at low cost in any kind of a plant are: First, high load-factor, about 60 per cent. By increasing the load-factor from 30 per cent to 60 per cent the total average costs per kw-hour may be cut down 40 per cent, which is a greater reduction than can be made by any other practical means. Second, high-efficiency plants, with scientific management from finance to furnace, and skilled labor to operate them. Third, lowest ultimate-capacity

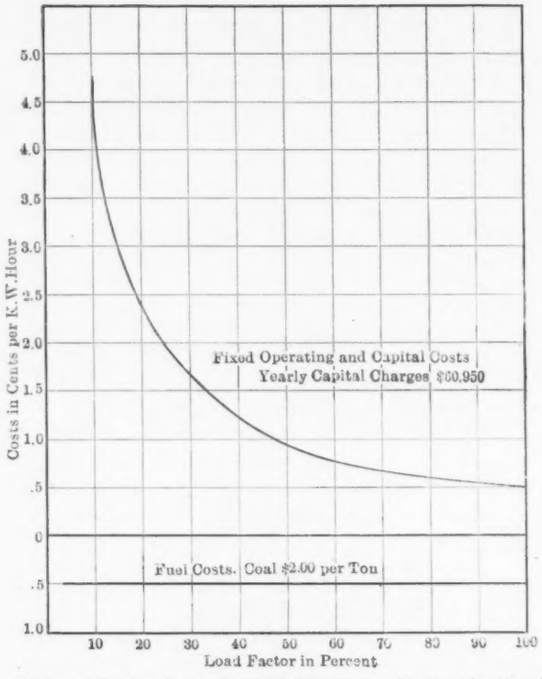

Costs in Cents per K.W.Hour
Load Factor in Percent
Fixed Operating and Capital Costs
Yearly Capital Charges $60,950
Fuel Costs. Coal $2.00 per Ton

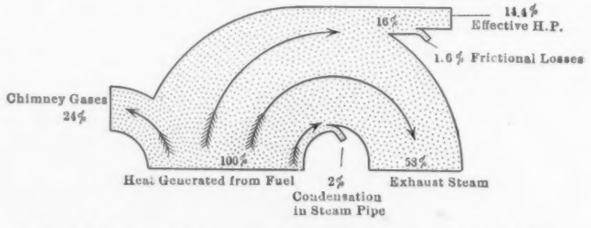
Fig. 2—Load Factor Curve for 3000-Kw Steam Station Costing $200 per Kw.

costs of equipment consistent with high efficiency and long life. Centralization of supply will bring the high load-factor and great diversity of demand and enable us to supply energy for any purpose demanded in any community."

PRACTICAL NOTES ON THE WORKING AND CONTROL OF STEAM BOILERS.

By John B. C. Kershaw.

THE aim of the writer is to draw attention to the lines along which progress is taking place in the working and control of steam boilers. The data are drawn partly from the writer's own experience and partly from his study of the recently published technical literature relating to boiler control and management. The heat-efficiency diagram presented herewith shows that steam engineers have considerable margin for improvement as regards the working efficiency of the ordinary steam boiler and engine. This diagram shows that of the heat energy liberated in the boiler furnace on com-



Heat-Efficiency Diagram for Steam Boiler and Engine.

bustion of the coal (represented in the diagram by 100) 24 per cent passes away with the waste gases, 58 per cent escapes with the condensed water and exhaust steam, and only 14.4

per cent is obtained as energy in the engine. These are average figures for the ordinary steam boiler and engine, working under normal conditions, without economizers, feed-water heater or superheater. Stating the problem in another way, 1 lb. of perfectly dry fuel of good quality will yield when burned 14,500 lb.-Fahr. units, equivalent to 11,281,000 ft.-lb. or to 5.6 hp-hours. Theoretically, therefore, a hp-hour can be obtained from the heat stored in 0.18 lb. of coal. The best results obtained in practice have been 2 lb. coal per hp-hour with marine engines and 1.6 lb. with steam turbines, or from nine to twelve times the amount required theoretically. The losses that occur in this method of converting the heat energy of the fuel into the kinetic energy of the engine piston are partly inherent in the use of steam and can be avoided only by the substitution of gas as the working fluid of the engine. The displacement of the steam engine by the internal combustion engine is, therefore, only a question of time. But the practical experience of the last few years has proved that considerably higher efficiencies can be obtained from steam plants than were considered possible five or ten years ago, and it is to the remediable losses that the author purposes to direct attention. The 58 per cent heat loss shown on the right side of the diagram and the 24 per cent loss on the left side cannot of course be entirely wiped out, but a considerable proportion of the heat units escaping with the exhaust steam and with the waste gases can be recovered and returned to the boiler. Although these economies do not improve the working efficiency of the steam engine as a prime mover, they considerably improve the efficiency of the whole plant, and reduce proportionately the working costs. The economies will be discussed under four headings, as follows: Fuel, water, combustion of the fuel and steam production.

FUEL.

Engineers anxious to economize in their power costs would do well to begin with the query, "Am I obtaining the best possible fuel at the lowest practicable cost?" A close study of this subject would in many cases lead to the answer, "No."

The economies possible to engineers in relation to fuel depend upon three factors, namely, the price delivered at the works, the quality as determined by calorific tests, and the number of dealers willing to quote for the supply of the type of fuel required. The wider the field of choice the more scope there is for economizing in the cost of fuel. It is unfortunate, therefore, that most engineers are convinced that one class or type of fuel only will give good results under their own boilers, since this limits their sources of supply and prevents competition. The possibility of adapting the furnace grate of the boiler and the methods of burning to the cheapest fuel available is rarely admitted and is still more rarely acted upon. Yet hundreds and in some cases thousands of dollars might be saved per annum if those in charge of large boiler plants showed a little more open-mindedness as regards choice of fuel. In nine cases out of ten the fuel which has least to bear in the shape of railway and cartage charges will be found the cheapest, and the wise engineer will therefore adapt his furnaces and, if necessary, his boilers also to the fuel which is mined closest at hand. If all boiler plants had been designed by practical business men this need for adaptation would not occur. Unfortunately the question of fuel costs is rarely considered until the plant is ready for operation.

One other point also deserves mention. Every colliery produces good and bad grades of fuel, and if furnaces can be adapted to the fuel, the fine slack or "dant," for which it is difficult at times to find a customer, will be found out-and-out the cheapest type of fuel, in spite of its 20 per cent to 30 per cent of ash. Coke-breeze is another cheap fuel which can be made to yield valuable results when burned under suitable conditions. Fuels containing high percentages of ash are, however, not economical when they have to be carried long distances by land or sea, and should not be used when ash disposal is costly or difficult. A higher rate of wages may have to be paid the firemen when burning these cheap fuels, and this must be taken into account when estimating the relative advantages and disadvantages of low-grade fuels. As regards the choice and control of fuel supplies for steam-raising purposes, the writer is a great believer in the value of laboratory tests. Such tests are not only an aid to the engineer in the selection of the most suitable and cheapest fuel, but they will serve as the basis for the fuel contract. The percentage of volatile matter in the fuel is also of considerable importance, and this can be easily determined by a laboratory test.

The application of scientific and exact methods in the choice and control of fuel supplies for steam-raising purposes has, in fact, made striking progress during the past few years on both sides of the Atlantic. It is now customary for engineers, before signing contracts for large amounts of fuel, to have before them the test figures for the percentages of moisture and ash, and for the calorific value, of representative or average samples of the fuels chosen as being specially suitable for the steam-raising plant under consideration. In many cases, fuel contracts are now framed upon what is known as the heat-unit basis. Under this system the purchaser buys heat units instead of tons of coal and the price rises or falls according as the fuel actually delivered yields, on testing, a larger or smaller number of lb.-Fahr. units than that chosen as the standard. This system of purchase has made most progress in America, where the United States government has taken the lead in the matter. It is also making headway in the United Kingdom and on the Continent of Europe. As proof that regular sampling and testing of the fuel are of practical value to the consumer the writer may cite the experience of two large manufacturing concerns which adopted this system of checking the supplies nearly two years ago. In the first case the heads of the firm have stated that although there has been but slight variation in the heat value tests they are persuaded that the regular sampling and testing of the fuel has promoted economy, since it has led to greater uniformity in the quality of the supplies. In the other case wide variations have occurred in the heat units, followed by "pro-rata" deductions from the price paid for the fuel. These deductions have caused the colliery owners to improve their plant for washing and screening the fuel, and the supplies are now once again up to the standard level as regards ash and heat units. The consumer here again is satisfied of the value of the system, and in both cases it is still being employed.

The need for some independent check upon the quality of fuel supplies was never more needed than to-day. Owing to various causes there is now more haste and less care used in the actual mining operations, and more shale and dirt are brought to the surface with the fuel than was the case some years ago. The larger portion of this dirt finds its way into the small coal or slack, and in many mining districts tests of the small coal from certain mines have shown that there has been a marked increase in the ash during the last few years.

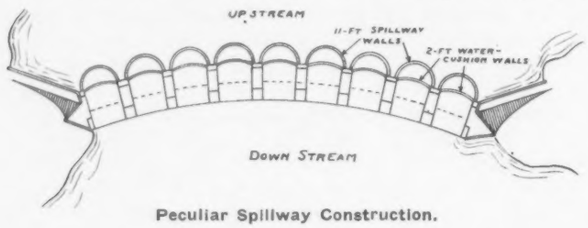
As regards the control of the fuel supplies, therefore, the writer is convinced that all fuel users consuming twenty tons or more of fuel per week would find it beneficial and economical to have regular samples taken of their deliveries even when no heat-unit basis has been adopted for the contract. The fact that samples are being regularly taken and tested can be made known to the seller, and this knowledge will have a marked effect upon the quality of the fuel supplied. In case of dispute the sample is also available for testing purposes, and if the firemen report any difficulty in keeping up steam ash and calorific tests can be made at once and the deterioration in quality can be confirmed or the reverse by the results of exact scientific tests.

This work does not necessarily involve the equipment of a fuel-testing laboratory or the engagement for his whole time of an expert chemist. The expenditure upon the sampling and testing can be varied to suit the requirements and size of the plant, and $100, $200 or $400 per annum expended in this way will usually save a still larger sum which would have been paid for several hundred tons of incombustible matter or "dirt."

LETTERS ON PRACTICAL SUBJECTS

A UNIQUE SPILLWAY CONSTRUCTION.

Hydroelectric readers of these columns will be interested in a unique spillway construction I saw in a recent trip through California. The finished spillway, as shown in the accompanying sketch, represents the solution of a problem of safely discharging a possible large overflow over a naturally restricted rectilinear distance, in this case providing for spilling 10,000 cu. ft. per second (theoretically requiring 414 ft. for the desired head) between abutments only 300 ft. apart. The spillway is part of the irrigation plan of the Orland project of the United States Reclamation Service, discharging from the reservoir level into the tail race 11 ft. below. The spillway proper consists of nine semicircular concrete walls 11 ft. high and 18 in. thick, reinforced by heavy concrete abutments, the entire dam being itself built on the 36-deg. arc of a circle of 474-ft. radius. The diameter of each spillway arc is 27 ft.



Peculiar Spillway Construction.

and the total curvilinear distance of the nine semicircular walls is 460 ft. Allowing for incomplete approach of the water, the available length of the spillway is thus 414 ft. Just below the 11-ft. weir walls are a second series of 2-ft. water-cushion walls similarly arched. These walls create lenticular pools 2 ft. deep at the base of the weirs, in which the force of the falling water is received and dissipated, cushioning the impact on the concrete structure. At the maximum flood of water which the spillway will have to discharge the weir gages will read only 3.7 ft. higher than the crest of the spillway. The spillway section is built into a sag in a conglomerate ridge which impounds the reservoir water, and tedious and expensive excavation would have had to be resorted to to widen the 300-ft. natural opening.

San Francisco, Cal. JAMES K. MONTSERRATT.

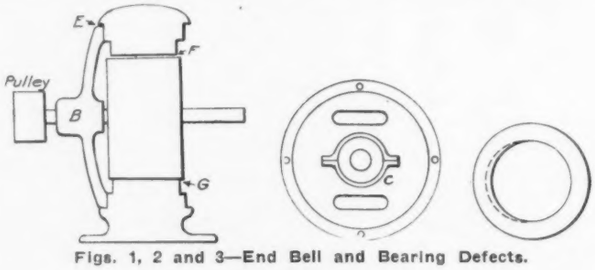
HARD BEARINGS VERSUS SOFT BEARINGS.

There seems to be quite an aversion to the use of hard boxes or bearings in which the journal rotates. This aversion is not only apparent with builders of motors, but also with builders of general machinery. It is only natural that the manufacturers of machinery should favor soft bearings because of the ease of manufacture and fitting to any particular machine, but such favoritism should not prejudice the practical engineer or electrician against the use or employment of hard boxes. Of course, those who are not accustomed to the use and practical utility of such bearings will in all probability talk against them. This may be due solely to the fact that their experience may be limited to the use of soft boxes. The writer admits that he favored soft boxes for years because he had not the opportunity to learn the usefulness and good points inherent in the hard box. For the past few years his experience has changed all this and this experience was a great educator. The disadvantages of the soft box are many. Practical men are aware that the soft box is incapable of withstanding a rise in temperature much above that which is normal to the feel of the hand or finger. Where the stress load or pull on the soft box is constant and a rise in temperature occurs two things may occur simultaneously. First the rise in temperature may increase, and second, the bearing will flatten, in the direction of stress. As the temperature rises, the solidity of the box becomes destroyed and the metal flows or runs and the usefulness of the box is lost. Another disadvantage of the soft box is that it is incapable of giving any indication of lack of attention or rise in temperature by sound, as does a hard box. Again, a rise in temperature can only be detected by feeling the bearing and since the motor may be located in an out-of-the-way place (as in the case of a motor boxed in and fixed to a high ceiling) it is evident the bearing will easily be destroyed owing to lack of attention, and in the case mentioned above the armature may be injured. The reliability of a hard bearing is immediately apparent, and the advantages are as follows: The bearing is capable of resisting a considerable rise in temperature and at the same time retain its shape and solidity. It indicates lack of attention by sound. It will last from three to four times as long as the soft bearing. The bard box can be used over again after it has been subjected to a temperature that no soft box is capable of withstanding, and this one advantage alone should commend its use to the practical engineer or electrician.

New York. WM. KAVANAGH.

DEFECTIVE INDUCTION-MOTOR END BELLS.

Small motors very frequently cause trouble by the failure of the bearings and especially of the one next to the pulley. In induction motors where the rotor touches the stator the fault is very often due to the frame of the machine, but more frequently the defect is caused by the failure of one of the bearings. When the end bell shifts it permits the rotor to strike, and such a condition is shown in Fig. 1, the bearing support having shifted as shown at the point *E* and allowing the rotor to strike the stator, as shown at point *G*. Where the air space *F* is measured at frequent intervals defects of this kind can be remedied before actual damage results. Very often induction motors can be found in which the end bell has enough play to permit the rotor to come in contact with the frame when under speed. This condition is indicated by excessive heating and may be remedied by placing dowel pins through the end bell to keep it from moving. Several ¼-in. pins will serve to keep the end bell rigid after the bolts have been tightened up. The fault may be usually traced to belt pull, and this is one reason why the cheap heavy cotton belts should not be em-



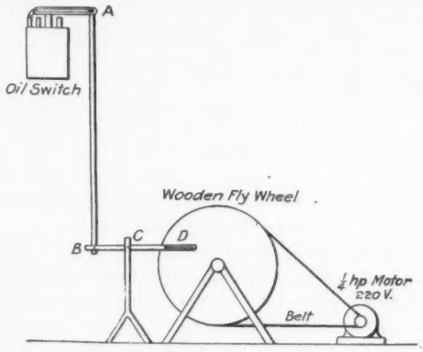
Figs. 1, 2 and 3—End Bell and Bearing Defects.

ployed on motors carrying heavy loads. The tension in such a belt must be very much greater than the tension in a good leather belt for the same service, so that more strain is imposed on the bearing, which soon wears and allows the rotor to come into very close proximity to the frame. Many motors have a loose bearing clamped into the side frame support, as shown in Fig. 2, and these work loose or become worn on one side, as indicated in Fig. 3. The writer has corrected faults of this kind by placing a paper liner between the frame support and the bearing, thus dividing up the air space around the rotor The type of motor having the removable shell bearing is preferable to one in which the bearing is fixed, as in the former case shells may be carried in stock and placed in the bearing quickly when one becomes worn. This is a feature of considerable importance where a number of motors are in continuous service.

Atlanta, Ga. ARTHUR JONES.

REMOTE CONTROL OF CIRCUITS.

The diagram herewith shows a simple device, reliable in operation, as well as inexpensive, for the remote control of either primary or secondary circuits. The writer prefers this scheme to solenoids or carbon break switches. We feed the three-phase motor from a No. 14 wire at a potential of 220



Remote-Control Apparatus.

volts, the distance from the office to the switch being a quarter of a mile. The oil switch connects the 2300-volt primaries with two series transformers, used for street lighting, and to reverse the direction of rotation of the motor, to throw the circuit on or off, a two-pole, double-throw switch is used. The center leg of the motor is always in circuit and when the switch is thrown in one position two of the phases are reversed. In the other position the connections are normal.

Park City, Utah. D. E. KING.

CURING CONCRETE FOUNDATIONS.

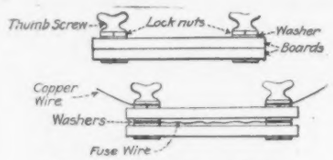
Concrete foundations, both those made of blocks and those monolithic, reinforced or plain, may be hardened in two or three days to a degree equal to the natural hardness obtained by twenty-eight days of frequent sprinkling. The quick curing may be done by the use of exhaust steam or steam at atmospheric pressure. The operation, as well as the apparatus necessary, is very simple. It is only necessary to inclose the foundation with some fairly tight covering—a box of matched boards, a mercerized tent or rough boards covered with plaster. Anything will answer which will prevent wind from blowing the steam from the concrete. If the foundation has been constructed in a fairly small room the room itself may be utilized as the inclosure for the foundation and steam turned into the room without any further covering of the concrete to be cured. The more moist the steam the better it will cure the concrete. If the work must be cured with live steam it is a good plan to discharge the steam into a trough of water which is maintained on an approximate level by means of an ordinary ball-float valve. This will at once remove any possible superheat which might exist in the steam supplied. The water will be boiled and vaporized by the higher-pressure steam, so that a very large quantity of moisture exists at all times in the curing chamber during the operation. Cement products cannot cure or harden unless they are supplied with the proper quantity of water to enable adequate crystallization to take place. Cement differs from lime in this respect, the products of which harden by carbonization, the lime being changed back again into original limestone by means of the carbon elements which chance to be present in the atmosphere. This being the fact, lime mortar will harden quickly when mixed and kept wetted with ordinary carbonated water, such as is used for a beverage. The hardening of the cement foundation may be still further accelerated by increasing the temperature of the steam with which it is surrounded. But as this can be done only by inclosing the foundation in a vessel capable of withstanding internal pressure there is little opportunity of still further hastening the curing of concrete by this method. The matter is, however, perfectly feasible, and concrete blocks, columns, shingles and all kinds of small concrete art stone are now cured in eight hours. In fact, any concrete articles which can be placed inside of a 74-in. x 74-ft. steel cylinder, on cars or otherwise, are now being cured in eight hours or less to a degree of hardness far beyond what is secured by twenty-eight days of ordinary air curing and constant sprinkling. As foundations cannot well be put into a curing chamber and subjected to steam of 150-lb. boiler pressure, even for so short a time as eight hours, it is necessary to resort to the comparatively slow process of curing with steam at atmospheric pressure, which requires from thirty-six hours to forty-eight hours—after the concrete has been once heated through. The specified time, then, does not begin with the minute the steam is turned on, but should be calculated from the time when the mass of concrete has become heated to the temperature of the surrounding steam-saturated atmosphere. A very good way in which to hasten the curing of large foundation work which is wanted in a hurry is to pipe around the bottom of the foundation with a line of pipes which has been perforated with very fine holes 1/16 in. or so in diameter, at intervals of 1 ft. or 1½ ft. The holes should be so located that steam issuing therefrom will flow directly toward the foundation as close to the bottom as possible. Then place a few boards around the foundations in a vertical position. Tack other boards outside, clapboard fashion, and as the boarding progresses toward the top of the foundation cover the boards with dirt, sawdust, tanbark, hay, straw, canvas, rags, or any material at hand, to keep the steam against the concrete work. When the foundation is well covered turn on the steam and allow it to flow to the extent that a little vapor always issues from holes left for that purpose close to the bottom of the foundation. Forty-eight hours of steaming will cure the foundation sufficiently to allow the machinery to be placed upon it and started at once. After the concrete has once been heated through, thirty-six hours' exposure to steam at atmospheric pressure will suffice to harden it. Repairs and additions to old concrete may also be treated by steam with most excellent results. But to make new concrete adhere to old requires that certain conditions be met. The surface of the old concrete must be clean. It must be rough and some holes, in dovetail form if possible, should be dug in the surface with a chisel and hammer. Dilute hydrochloric (muriatic) acid should be applied and rubbed into the old concrete with a stiff fiber brush—the acid will destroy a bristle brush almost instantly—after which the concrete surface should be washed free of acid with a very large amount of water. The old surface can be covered with a thin mixture of cement and water—as thick as ordinary whitewash. The concrete should be wet when this wash is applied and it also should be wet before the new concrete is applied. The above precautions having been taken, build on the new concrete section, or replace the broken portion, then cover and steam as above directed and the resulting concrete repairs can be depended upon to show plenty of strength in thirty-six to forty-eight hours, provided the work has been properly carried out as directed and the new concrete properly proportioned, mixed and applied. This method of curing concrete can be made to play a most important part in emergency repairs as well as in new work.

South Bend, Ind. JAMES F. HOBART.

TESTING TRANSFORMERS FOR INSULATION.

Central-station managers in small towns are often worried about the possible breakdown of the insulation of transformers, which might cause fires in buildings by coming in contact through the house wires, with gas pipe at the outlet of the chandelier or other possible grounds or shock customers in the act of turning on the circuit at a brass lamp socket. Every central-station manager knows what an accidental death due to electricity would mean to his company through the fear of consumers to use electricity any longer. The knowledge that one of their townsmen had met death through a medium

which was connected to their own homes would deter many from using electricity at all. There would be, also, the usual expensive lawsuit to consider. For a public service corporation in a small town to succeed the confidence of the townspeople is necessary. All transformers should, therefore, be



Figs. 1 and 2—Fuse Blocks.

tested occasionally to make sure the insulation is perfect. This should be done when the transformer is inspected to see if the proper amount of oil surrounds the windings. It is then a simple and easy matter and should not be neglected. The following is a description of how transformers can be tested on the ordinary 2300-volt line, disconnecting the consumer from service only a few minutes if the transformer insulation proves to be sound. If it proves otherwise it is well to disconnect the transformer from service for such time as is required to install a new one. Fig. 1 shows a handy fuse block suitable for this purpose. It is constructed of two pieces of wood 1 in. thick, 3 in. wide and 12 in. long. The two pieces of wood are clamped together, as shown, by means of thumbscrews and bolts. Between these blocks and fastened as shown in Fig. 2 a piece of ¼-amp or ⅛-amp fuse wire 10 in. long should be fastened. Under the locknuts and washers shown

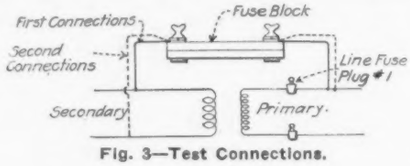


Fig. 3—Test Connections.

in Fig. 2 a piece of copper wire should be attached. This forms a cheap, ready-made fuse block which can be thrown about without danger of breakage. The lineman can readily fasten it to his belt by means of the copper wire when climbing the pole. The fuse block should be attached to one of the primary wires and to one of the secondary wires, as shown in Fig. 3. Should the secondary be connected to ground the ground connection should be disconnected. In small towns the secondary is rarely connected to ground. Were the ground connection allowed to remain in place while making a test the result might be misleading should a ground exist on the opposite primary line. After connecting the fuse block as shown the fuse plug No. 1 protecting the transformer should be withdrawn from its receptacle. Should the insulation of the transformer be defective the current would flow through the defect into the secondary coils and through the fuse wire into the other primary line. This would cause the fuse to blow, showing that the transformer insulation is defective. No fear need be felt about throwing a short-circuit on the line through the fuse block, as the load ⅛ amp or ¼ amp would do no harm should the insulation allow the current to flow. The connection to the primary line should now be transposed,

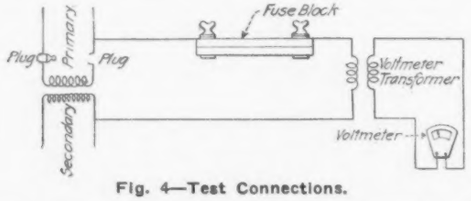


Fig. 4—Test Connections.

placing it upon the other primary line, withdrawing fuse plug No. 2 and reinstating fuse plug No. 1. This is done because it is possible that a slight defect may exist in a part of the windings which might have sufficient self-induction to choke the circuit when connections to the first primary line are made. When the transposition is made it lessens the self-induction and should the defect exist the fuse will blow. Should one fear using the fuse block the same connections can be made by using the fuse block in series with a voltmeter and shunt transformer as shown in Fig. 4. This would be absolutely safe, but a low reading on the voltmeter should not be neglected, as it indicates that a defect exists and should be attended to. Station managers should not neglect the testing of transformers, as it is an easy matter for a careless workman to be careless in the use of the oil used for insulating and cooling the transformer windings, thus rendering it injurious. The writer knows of a case where cylinder oil was used by a lineman because it was oil and looked like the oil he had put into other transformers. Within six months' time complaints were received from customers that they received shocks when they touched their chandeliers. The writer personally investigated and found it possible to get a slight spark through the glass of the electric lamp similar to that produced by small static apparatus. The transformer was removed and the oil found to be in a blackened state. New oil was substituted and the shocks were no longer experienced. Upon testing the transformer a very noticeable leak was found between primary and secondary. The insulation was in a very bad state, being badly decomposed or disintegrated by the action of the oil upon the insulation. This was a rare case, as the lineman was also superintendent of the plant and knew absolutely nothing of the uses or abuses of transformers, having had no experience in alternating-current work. The plant had recently been changed from a direct-current system and he had been retained in charge. The importance of careful handling of transformer oil should be realized from the fact that the entrance of moisture into the oil lessens its insulating properties considerably and it is an easy matter for a careless workman to leave the cap off the cans in which the oil is usually transported, allowing moisture and other injurious foreign matter to find their way into the oil.

Brooklyn, N. Y. T. W. Poppe.

REBABBITTING MOTOR BEARINGS.

The continuous operation of motors and generators depends very largely upon the care bestowed upon them, and this is especially so of small motors. Many of the latter are thrown out of commission because of lack of attendance or for the

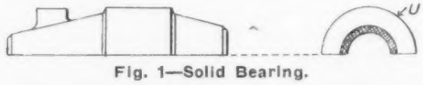


Fig. 1—Solid Bearing.

want of proper setting. This is not only true of direct-current motors, but also of alternating-current motors, the general impression being that the latter require no care whatsoever. Where induction motors of the squirrel-cage type are set on some pieces of timber or on a vibrating foundation the vibration will cause the insulation to work out much more quickly and proper service thereafter is impossible. A good foundation is very essential for the reliable operation of motors. The care of bearings is also another important consideration, and the mere fact that a motor bearing is working well to-day does not mean that it will be in the same working condition an hour hence. It is advisable where motors are used very much to

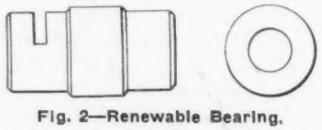
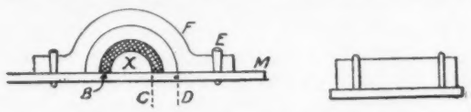


Fig. 2—Renewable Bearing.

carry a separate set of bearings in stock for each size of motor in operation, so that when the babbitt is melted or becomes loose it may be replaced without the necessity of shutting down the motor for any considerable length of time. Some motor bearings have an iron shell lined with babbitt metal which is

poured in place, while others have a finished babbitt liner. Fig. 1 shows a bearing of the former type, and such are very difficult to repair, especially if ring oilers are used. Fig. 2 shows a bearing in which the babbitt is merely slipped into place. A jig for rebabbitting bearings is shown in Fig. 3. This consists of a plate *M* on top of which is a yoke piece *F*



Figs. 3 and 4—Bearing Jig and Arbor.

bored out to fit the bearing surface *U* (Fig. 1). An arbor *X* represents the diameter of the motor shaft. The distances *C* and *D* must be accurate, so that the bearing will fit when placed in the motor. The pins *E* serve to hold the housing in place while the babbitt metal is poured. In the engraving, Fig. 3, the babbitt metal is represented at *B* and a side view of the arbor is shown in Fig. 4. The latter shows the projecting rings to form the oil grooves. A jig of this kind will be found very useful for repairing separate motor bearings and a bearing such as that shown in Fig. 1 can also be repaired in this way, as the fitting forms the guide for the centering of the shell for the babbitt metal. Great care must be taken in the construction of the jig so that the babbitt lining will be true, otherwise it will not fit the shaft and will run hot.

Lynchburg, Va. C. R. McGAHEY.

CUSHIONS FOR GENERATING SET FOUNDATIONS.

Vibrations are sometimes transmitted from operating generating sets and engines through the foundations to the structures in which they are installed. This difficulty most frequently occurs where the foundation is in intimate contact with the foundations of the building, but it may be encountered where the engine and building foundations are entirely distinct. In such cases the vibrations are transmitted through the soil in which the building and engine foundations are embedded. It has been found that if engine foundations are cushioned with a layer of sand no vibrations are transmitted. For installations where vibrations would be objectionable sand cushioning is often resorted to.

One method of sand cushioning is shown in Figs. 1 and 2. A box-like depression is arranged in the floor and a layer of sand is interposed between the inner walls of the depression and the foundation, which fits down in it. To prevent any settlement of the foundation that might be caused by sand being forced out, copper plates are arranged in the floor slab to seal the opening around the foundation's top. The floor slab should not touch the engine foundation at any point. A plan view of the construction suggested in Fig. 1 is given in Fig. 2. As indicated, the top floor is cut away from the foundation for a short distance all around, leaving an open space.

In constructing the foundation of Fig. 1, the depression having been molded in the floor, a layer of clean, dry sand is placed

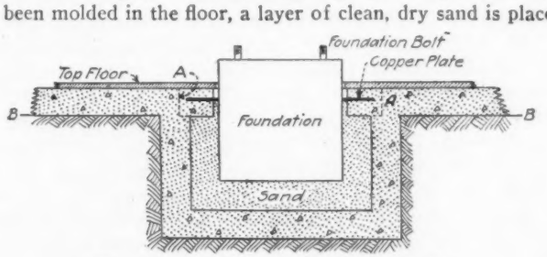


Fig. 1—Foundation Cushioned in Sand.

in its bottom. It should be noted that the section of concrete, between the dotted lines *A* and *A*, containing the copper plate is not placed until the foundation itself has been completed. Then a layer of oiled paper is placed on the bed of sand and the form for the foundation is erected on the paper. The form is lined with oiled paper and the foundation is poured. After the concrete has set the form is removed and the oiled paper is allowed to remain. The space between the foundation and the depression walls is filled with sand as high as the line *BB* (Fig. 1). The concrete section included between *A* and *A* is then poured, the copper plate being embedded in it. All of the space below the copper plate is carefully filled with sand before the plate is cast into position. Oiled paper is used as a lining,

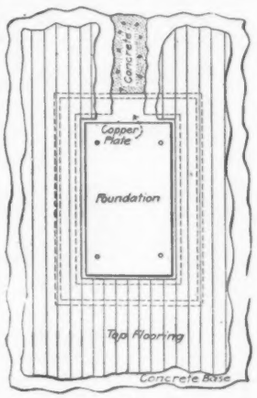


Fig. 2—Plan View of Fig. 1.

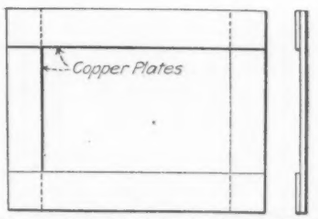


Fig. 3—Method of Arranging Copper Plates.

when the section *AA* is poured, to prevent concrete from flowing into the sand.

Four sections of copper, as shown in Fig. 3, compose the copper plate. It is not necessary to rivet the sections together because a shovelful or two of concrete will hold them in position until the whole volume of it is poured.

Where the floor and building foundations of a structure are waterproofed a construction more elaborate than that of Fig. 1 must be adopted. Fig. 4 shows a transverse section of a cushioned foundation designed for the East Side Commercial and Manual Training High School of Newark, N. J., under the direction of Mr. George W. Knight, supervising engineer for the Board of Education of that city. This foundation is waterproofed. The 4-in. brick wall constitutes part of the form for the concrete sides of the foundation and provides a surface on which the waterproofing can be laid. The rectangular projection from the concrete side wall is a key for the waterproofing. The 1-in. layer of cement in the bottom of the depression forms a protective coating for the depression-floor waterproofing. A foundation of this type is constructed in much the same manner as the one previously described. After the depression has been built the layer of sand is placed in its bottom and oiled paper is laid on top to prevent the concrete from mixing with the sand. The foundation form is built on the paper and sand stratum and is lined with oiled paper. After the concrete has been poured and has set the form is removed and the oiled paper allowed to remain. Sand to fill the side spaces is introduced and the floor course of concrete is laid.

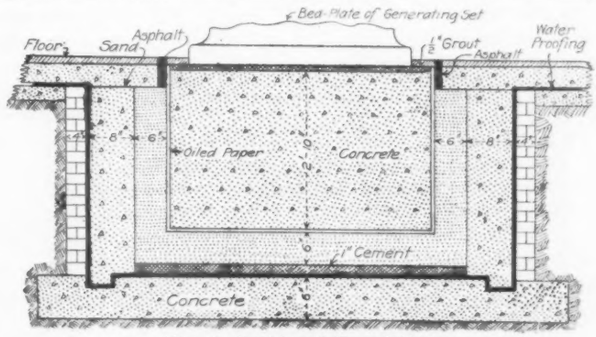


Fig. 4—Cushioned Foundation.

Instead of a copper plate a ring of asphalt is used in this design to prevent the sand from being forced out. The layer of grout is introduced between the bedplate of the generating set and the top of the foundation after the foundation has been completed and the generating set aligned and leveled. The ring of asphaltum is 1 in. wide.

Philadelphia, Pa. PAUL J. CARTY.

QUESTIONS AND ANSWERS

In three-phase motors having three coils per group per pole the throw of the winding in one is one and ten and in the other one and nine. How will this affect the motor, and what effect has the throw or pitch of the winding on the operation of the motor? C. L. H.

In a three-phase induction motor provided with three coils per group per pole, any one of a number of different coil pitches may be employed. A coil pitch exactly equal to the pole pitch of the motor will necessitate a minimum current for any chosen amount of magnetism, and will require the minimum magnetism for producing any given value of counter electromotive force. When the coil throw is less than the pole pitch an increased amount of magnetism is required for producing the counter voltage, and an increased current is required for producing this magnetism. The wattless volt-amperes required for excitation vary approximately with the square of magnetism required. These facts are discussed at length in the appendix and Chapter IX of McAllister's "Alternating Current Motors."

It is desirable to reduce the all-day core loss of a transformer where the latter is connected to a lighting circuit imposing no load on the secondary. How can this be performed? W. J. H.

The low-load losses of a transformer, which consist largely of the core losses, can be reduced by connecting in series in both the primary and secondary circuits a transformer designed for the normal e.m.f. and transformation ratio, but having a rating about equal to the low-load value. Under normal full-load conditions both the primary and secondary circuits of the small transformer should be short-circuited, in which case the full e.m.f. is impressed across the large transformer, which therefore carries all of the load. Under low-load conditions the short-circuit should be removed from both the primary and secondary of the small transformer. In this case the total voltage is divided between the two transformers in such a way that the small transformer operates at almost the full voltage, while the large transformer consumes merely the remainder. The excitation of the large transformer being greatly decreased, its core losses practically disappear, while even the core losses in the small transformer are slightly less than its normal.

If a three-phase watt-hour meter when tested with the two series coils in series and shunt coils in parallel is correct, but when each element is tested separately one is found to be 1 per cent fast and the other 1 per cent slow, will the meter be correct on power factors below 50 per cent? It would seem that if the element which is 1 per cent slow were negative the meter would run fast. S. R. N.

Without definite information as to the cause of the inaccuracy in the registration of each element of the polyphase watt-hour meter it is impossible to state definitely what effect would be produced at power-factors below 50 per cent. An error of 1 per cent might mean 1 per cent of the watts, or it might mean 1 per cent of the volt-amperes, or again it might mean a constant error of 1 per cent of the full-load registration of the instrument. In the last-mentioned case a change in the power-factor would have no effect; in the first-mentioned case a change in the power-factor would have the maximum effect, and in the second-mentioned case there might or might not be an effect, according to whether or not the load was balanced. In any event it is preferable for the separate elements of the meter to be as nearly accurate as possible in order that all sources of error may be eliminated.

Two hydroelectric plants situated two miles anart are operated in parallel and the regulation is all taken care of in one plant which has a 300-kw, three-phase unit governed by a water-wheel governor and a Tirrill voltage regulator. The machines at the other plant are run without governor or regulator. How should the excitation to be carried at the second plant be determined? G. E. M.

When two separate hydroelectric generating plants are operated in parallel, and the load regulation is accomplished solely at one of the stations, the excitation at the remaining station should be so adjusted that the current supplied by this station is the minimum. The power which this station will supply to the system is independent in every respect of the excitation, depending solely upon the opening of the inlet valves on the turbines. If the excitation is too low, the machine will operate at an excess of current, the excess current being such as to assist in magnetizing the generator. When the excitation is too high, the machine likewise operates at a low power-factor, the excess current in this case being such as to demagnetize the generator. The minimum current is obtained when the excitation is such that the machine requires no wattless current from the system and delivers no wattless current to the system.

If the field and armature coils of a 500-volt direct-current shunt motor are connected in multiple so as to make the machine operative on a 250-volt circuit, what will be the effect on the horse-power rating of the machine? Suppose a 500-volt direct-current shunt motor has its field coils connected in multiple so as to be operative on a 250-volt circuit, but its armature coils are left connected as originally for 500 volts, what will be the effect on the horse-power of the machine when operated on 250 volts? I understand, in designing a transformer, for every turn on the secondary winding there will be 1 volt induced from the primary winding. Now, how are the amperes predetermined? For example, it is desired to build a transformer capable of reducing a pressure of 100 volts to 50 and delivering a current of 10 amp from the secondary. The primary coil would consist of, say, 100 turns and the secondary would contain 50 turns. How is just 10 amp obtained? A. E. K.

When both the field coils and armature coils of a 500-volt motor are changed from the series connection to the parallel connection in the ratio of two to one, the machine becomes a 250-volt motor, and will operate at the same horse-power output as formerly with no change in its characteristics other than a slight increase in heating at the commutator. The current at 250 volts will be twice as much as at 500 volts, and to obtain satisfactory performance at the brushes it is desirable to double their cross-sectional area. When the field coils of a 500-volt motor are connected in parallel so as to be operative on a 250-volt circuit, but the armature coils are left connected as though for 500-volt operation when the motor as a whole is run at 250 volts, the speed will be reduced to 50 per cent of its normal value and the permissible output will be decreased by 50 per cent. As a matter of fact, the machine will operate exactly as though the field coils had been connected in series and subjected to 500 volts and the armature had been subjected to 250 volts, as is frequently done with three-wire operation of motor installations. It is incorrect to assume that in every type of transformer the e.m.f. will average 1 volt per turn. As a matter of fact, only in small transformers is this the case. The average e.m.f. per turn varies slightly less than 1 volt per turn in the very small transformers to 2 volts per turn in a 4-kw transformer, 3 volts per turn in an 8-kw transformer, reaching 5 volts per turn in a 32-kw outfit, etc. The values given above apply to 60-cycle transformers in which use is made of fairly good sheet iron. The proportions would be altered if use were made of silicon steel or the frequency were either greater or less than 60 cycles. However, in the case mentioned by you 1 volt per turn is a fair value to assume. Assuming that you have in mind a 60-cycle transformer, the cross-sectional area in order to produce 1 volt per turn should be about 10 sq. in. If the transformer is wound with 100 primary turns and 50 secondary turns, it will be suitable for operation at 100 primary volts and will deliver 50 volts at its secondary terminals. Quite independent of the size of wire with which the transformer may be wound, it would deliver almost any value of current demanded, operating in this respect exactly like a direct-current generator. However, for each size of wire there would be a limiting current beyond which the coils would become overheated. If it is desired to wind the transformer so that the secondary circuit will carry 10 amp without overheating the secondary wire should be about No. 10. With 10 amp in the secondary the primary would carry 5 amp, and for a moderate amount of heating the primary conductor should be about No. 7.

Central Station
Management, Policies and Commercial Methods

ELECTRIC VERSUS HORSE-DRAWN WAGONS.

Mr. F. H. Tidnam, manager of the Oklahoma Gas & Electric Company, Oklahoma City, gave some interesting figures comparing the operation of electric and horse-drawn wagons in Oklahoma City in a paper read at the recent Byllesby convention in Chicago. In June, 1910, the gas-meter department of the company purchased a 2000-lb. electric truck which displaced two one-horse wagons. For the month preceding the cost of operating these two wagons, with two metermen and two helpers, was $345, which figured out an expense of 35 cents per order for 987 orders executed. Compared with this the cost of operating the truck for a month was $209.90, including the wages of one meterman and one helper. Electrical energy was charged at 4 cents a kw-hour. More orders were executed than in the case of the two horse-drawn wagons, the number being 1092, and the cost per order executed was only 19 cents. The total saving effected was $137.20 in favor of the electric truck.

At the present time there are in Oklahoma City about 140 electric motor vehicles and six electric commercial trucks. Mr. Tidnam exhibited a table showing that the revenue derived from the sale of electricity for charging automobiles in Oklahoma City had increased from $62.50 for the month of January, 1910, to $458.96 for the month of December, 1910. The total revenue for the year from this source was $3,370.75.

ENERGY CONSUMPTION FOR ELECTRIC ICE-MAKING.

An average expenditure of from 50 kw-hours to 60 kw-hours is required to produce one ton of ice by means of a motor-driven ammonia-compression system. The maximum demand of such an outfit reaches about 2.3 kw per ton of ice-making capacity. Of this demand about 1.5 kw per ton is due to the compressor itself, the remainder representing the work of the auxiliary apparatus. These figures represent the conclusions reached by a large central-station company after a study of a number of ice-making plants where electrical energy is used in motor-driven compressors.

SPECIAL STREET LIGHTING AT GENEVA, NEB.

Geneva is the county seat of Fillmore County, which is considered one of the best farming sections in the State of Nebraska. The population is 1741, and as a town it cannot lay claim to any greater advantages than any other town of the same size, unless it be that the management of the electric light company is very progressive. The illustration herewith shows the system of lighting in use along the two business blocks of the town. There is a park opposite these two blocks, which accounts for all the lamps being on one side. The fixtures were made up by the Geneva Electric Company, as it was very difficult to secure one that would be flexible enough to suit all requirements. The scroll work was made by a local blacksmith out of ¼-in. x ¾-in. iron and is secured to the fixture by a 5/16-in. bolt passing through both sides of the pipe. The other end of the scroll is fastened to the building by two 5/16-in. bolts or screws. The local manufacture of these scrolls was a very great convenience, as some of them had to be made of varying lengths to fasten to cornices and other projecting parts of the building fronts.

The fixtures were placed about 16 ft. above the sidewalk and spaced 24 ft. apart. Each contained a 60-watt tungsten lamp in a 10-in. straw opalescent ball with a 4-in. holder. The wall plates, sockets, holders and other fittings were furnished by the Benjamin Electric Company, and a 5-ft. length of ¾-in. conduit forms the stem. The total cost of the fixture was about $3.50 exclusive of the lamp. They were installed complete at a cost

Special Lighting at Geneva, Neb.

of $5 each to the merchants, plus a charge for service of $1 per month.

The lamps burn from dusk to 10:30 p. m. during the week and until midnight Saturdays. The electric light company agrees to take care of all renewals at its own expense, thereby assuring an unbroken string of lights. The installation is taken care of through a commercial club which guarantees all charges and does all collecting as well as taking care of any vacancies that may occur. This is quite a convenience to the electric light company, which bills the club for a lump sum. There are thirty-nine of these fixtures, thirty-two being on the main street and seven on a side street. They have been in operation over five months and have been exceedingly satisfactory both to the public and to the local lighting company, of which Mr. G. S. Sprague is superintendent.

"STAPLES" AND "NOVELTIES" IN ENERGY-CONSUMING DEVICES.

In the course of a paper entitled "Advisability of Utility Companies Handling Gas and Electric Appliances," read at the recent convention of Byllesby companies in Chicago, Mr. Samuel Kahn, manager of the Union Light, Heat & Power Company at Fargo, N. D., said, among other things, that a public-utility company should discriminate between what he called "staples" and what are considered "novelties." By a "staple" appliance he means one that will sell for a few dollars and be of such usefulness that it becomes indispensable to the customer and therefore goes into regular service. The electric flatiron is mentioned as an example. Such an appliance is sold for $3.85, and if used on an average fifteen minutes a day the annual consumption will be 50 kw-hours, which, at 10 cents, will amount to $5 a year. On the other hand, as a "novelty," the washing machine may be mentioned. A good machine of this character cannot be purchased for less than $50, and the annual consumption of energy may be estimated at 27 kw-hours, producing a revenue of $2.70.

Mr. Kahn took pains to disavow the conclusion that washing machines and other appliances, like vacuum cleaners, heating pads, vibrators, etc., should not be displayed and sold by the central-station company. In certain industries these so-called "novelties" become "staples," for a laundry will use a washing machine continually, a house cleaner will need the vacuum cleaner many hours daily, a hospital will require heating pads in regular service, and a "beauty parlor" or barber shop will find the vibrators almost invaluable. Each appliance, when used in some place to which it is particularly adapted, is productive of appreciable returns.

DISTRICT SYSTEM OF METER READING.

"District System of Meter Reading" was the title of a paper read at the recent convention of Byllesby companies in Chicago by Mr. T. K. Jackson, president of the Mobile Electric Company of Mobile, Ala. By this term is meant the division of a city into a number of districts, reading and billing meters in each of these districts as a unit. In Mobile, where there are 5500 customers' electric meters, the city is divided into three such districts. The first step necessary to put into effect the district system of meter reading was the amendment of the city ordinance, which provided that a discount be allowed on all bills paid between the first and tenth of each month. This change was made without opposition. The city was then divided into districts, each having substantially the same number of meters and each having well-defined geographical boundaries.

The entire aim of the district system of meter reading was to eliminate peak-load conditions in the work of the employees of the company, and the result desired has been attained. The number of meter readers has been cut down from five to two, with an extra man to assist in making check readings and second readings. The cashier, complaint clerk and ledger clerks of the company find their work much easier, being spread throughout the month in a uniform manner. All bills are now rendered within ten days of the meter-reading day and become delinquent ten days later.

The most valuable result to the company is that by reason of having meter readers who are continuously employed fewer mistakes are made in reading meters; furthermore, as the ledger clerks are not greatly hurried fewer mistakes are made in billing, with less dissatisfaction among customers. Mr. Jackson believes that the district system of meter reading will be an unqualified success for companies which have more than 2000 consumers. He thinks an additional meter-reading district should be made for every multiple of 2000 consumers. He believes that the adoption of the district system of meter reading results in a great decrease in the losses due to failure to collect. He points out that on Dec. 28, 1907, the delinquent report of his company showed $6,906; on Dec. 26, 1908, it was $1,125; Dec. 27, 1909, $1,731, and Dec. 31, 1910, $801, showing a material decrease.

THE PRESENT TUNGSTEN-LAMP SITUATION.

An interesting paper entitled "Effect of Low-Wattage Lamps on the Central-Station Industry" was read by Mr. Alex. F. Douglas, of Portland, Ore., assistant manager of the new-business department of H. M. Byllesby & Company, at the recent convention of Byllesby companies in Chicago. Mr. Douglas gave a sketch of the development and introduction of high-efficiency lamps and showed the important question presented to the central-station company by the appearance of these lamps, with their low rate of consumption of electrical energy for the same amount of light, compared with carbon lamps. Many of the central stations finally realized that the proper handling of the new lamp meant more business for them, rather than the cutting down of their revenue. The new lamp has proved extremely useful in competing with gasoline and acetylene lighting. The speaker cited the example of Milwaukee Avenue in Chicago. More than two years ago the lighting on the street was 75 per cent gas; to-day, he said, it is just the reverse, being 75 per cent electricity, and this change must be credited to the tungsten lamp.

To-day, Mr. Douglas said, the lamp-manufacturing companies have in mind the introduction of 10-watt, 15-watt and 20-watt multiple tungsten lamps, and the question again arises, What shall the central station do to meet the situation? In view of the experience with 40-watt and 60-watt tungstens the speaker's conclusion is that the central station need not fear the new low-wattage lamps. These lamps will be relatively expensive and undoubtedly will be fragile. In addition they will necessarily be of relatively poor efficiency as compared with tungsten lamps of greater energy consumption. The cost of renewals per kw-hour may become so great that the use of the low-wattage tungsten lamps may not be economical unless the cost of electricity is very high. The raising of the standard of illumination will be further aided by the low-wattage lamps, for more lamps will be burned than heretofore. The new lamps will widen out the field for outline and display lighting and may replace small carbon lamps for hall lighting and be used with much greater freedom. Everybody likes a cheery and well-lighted house, and the new units should encourage the use of a greater number of lamps.

In concluding Mr. Douglas urged his hearers not to hold off until the situation was forced upon them. Now is the time to grasp the situation and get control of it. Every man in the new-business department should be posted on the most up-to-date methods of lighting. The central-station man should advertise the fact that he is willing at all times to assist his customers to obtain better light and stands ready to supervise any installation made to that end.

A WAY TO SOLVE THE TUNGSTEN PROBLEM.

By J. E. Bullard.

Any central station using rates not based on the three components, fixed charges, customer charges and production charges, will of necessity suffer from the tungsten invasion. The extent of the suffering will depend on the way the situation is handled by the management. The course too often pursued is to make a vigorous campaign for the class of business yielding the least profit—in other words, lighting small stores with tungstens. Residence lighting is likely to prove more profitable, for, though the revenue per customer is smaller, the introduction of various domestic heating and labor-saving devices may increase the consumption sufficiently to offset the bad effects of the tungstens. Flat-rate, off-peak sign lighting, etc., is a good way to increase the lamp load. In my opinion, however, it is far better to pay less attention to lighting and bend all the energies to increasing the motor load.

The motor load is profitable. If we define load-factor as the ratio between the actual yearly consumption and the maximum demand multiplied by 8760 we discover the following: The load-factor for lighting varies from 5 per cent to 26 per cent, with an average of 11 per cent. The motor load-factor in the case of motors rarely used may be as low as 5 per cent, while on such loads as twenty-four-hour pumping it will pass 90 per cent. Though the motor load-factor may fall below that of lighting, there is the advantage that the motor can be, and usually is, used off the peak, while lamps must be used on the peak. Again, the motor has probably reached as high an efficiency as it ever will. This means there is no danger of a decrease in revenue due to higher motor efficiency, but there is a likelihood that the incandescent lamp will reach a much higher efficiency in the not very distant future.

It would seem that in the presence of these facts all central-station managers would see the advisability of adding all the motor load possible. It would seem that their motor departments would be highly organized, and would collect and file accurate data on all the prospects in the territory served by the company. This, however, is rarely the case. The investigating

done by the writer leads him to believe that the average central-station manager handicapped by unscientific rates pays far too little attention to his one great opportunity.

A certain manager speaking about the need of giving prospective motor users accurate data expressed the opinion that the selling of energy for motors in his city was mainly a "matter of bluff." He did not think it advisable to give the users of a large motor load full and accurate information, since a competing electric supply company might get hold of this information and make use of it. Another manager said it was not necessary for him to employ a regular motor-load salesman because the large manufacturers were willing to send a man to sell motors to all prospective motors users. A number of central-station men outside the large operating companies have expressed their opinion that there is danger of giving their prospective motor users too much time and information. These companies are losing great opportunities, while those who do go out and give these prospects all the information and attention necessary to get their business are daily increasing their profits.

In one case two central stations of about the same capacity served populations of nearly the same size and each had manufacturing establishments as prospective buyers. One company sold energy at a very low rate, had no highly developed sales force and would not give definite and accurate information. It is getting few orders and is facing strong competition. The other company has high rates, gets most of its business by closing down existing steam plants and has a highly developed motor department which goes into the minutest details and sticks to the prospective buyer until he "signs up" or dies. This company has comparatively few complaints, and probably will never have to fight competition. This alone is a strong argument in favor of giving a motor-load buyer all the necessary information. You would have very little confidence in a tailor who could not tell you the price of a suit before he made it, and who insisted he could guess near enough to make it unnecessary to measure you. This, nevertheless, is the way a great many central stations are going after their motor-load business.

The secret of success in the motor department is industrial engineering. Local conditions will determine how much engineering is necessary. In some cases it may require no more than indicating engines and general testing. In most cases, however, and especially in manufacturing towns, it requires extensive and accurate engineering work. There the industrial engineer should not only ascertain the cost of operating the plant of the prospective buyer with its present equipment and with electricity, but he should as nearly as possible figure the cost to the central station of supplying the energy. In this way the central station will be enabled to secure the most profitable business.

Large business concerns have a very accurate knowledge of the size of the market they can supply, and can tell quickly when they are losing to competitors. Too many central stations have acted on the supposition that they have no competition. They apparently have overlooked the activity of the steam-engine, producer-gas and gas-engine salesmen. There is scarcely a central station possessing an accurate record of all the power users in the territory it serves. It is self-evident how valuable such a record would be. It should give the size of the different plants, their present cost of energy, the cost of operating these plants by electricity and the cost to the central station of supplying the energy. If an industrial plant has a breakdown the central station should immediately offer them a complete and attractive proposition. If the central-station company is about to build a new generating plant it can more closely estimate the size and the most economical site on which to erect it.

The best efficiency from the coal pile to the engine flywheel may be placed at about 10 per cent. In the average industrial plant it is only about 2 per cent. This leaves a wide margin to the central station for transmission and other expenses not a part of the energy costs of the private plant. In spite of this fact there are in every town many plants in operation simply because their owners do not know the cost of the energy from their own plants, and the central station has never taken sufficient interest thoroughly to investigate and test those plants.

A very promising feature about the motor load is that practically no improvement which increases efficiency can be applied with advantage to the small plant. This means that while engine and boiler efficiencies gradually increase in the large units used by the central station they remain almost constant in small ones used in the private plant. Also the majority of small units used to furnish energy to factories are not operated at their greatest economy. The engines are likely to be out of adjustment, the boilers poorly fired or some other loss is in evidence.

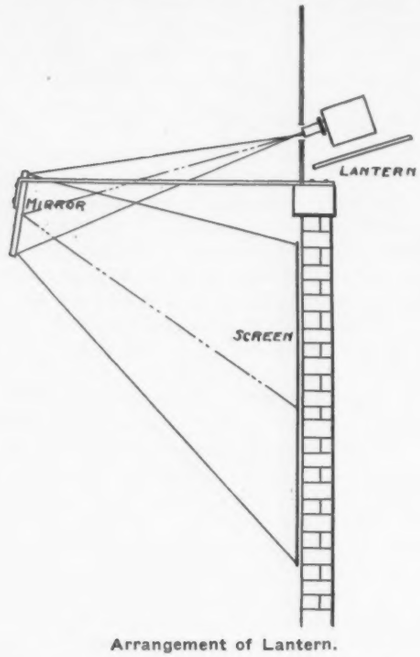
Gas engines have a full-load efficiency of 20 per cent. They, however, will carry no overload, which means that the units must be much larger than steam units capable of doing the same work. This means the engines are rarely run at full load and the actual working efficiency is low and the cost of fuel high. In most cases gas engines operated by producer, natural or artificial gas can be displaced if the actual operating expense is carefully ascertained. Usually the fuel bill in the case of the gas engine does not represent more than 50 per cent of the actual energy cost. In the case of the steam engine the fuel cost rarely represents more than 65 per cent of the total energy cost. This is a fact overlooked by the user. It is not so much his fault as that of the central station. He does not keep his energy costs carefully separated from his other factory expenses, and though the central station has told him this fact it has not proven to him what his energy costs actually are. He, therefore, thinks he should get electricity for the price of fuel or less, and too many solicitors of motor service apparently hold to his opinion.

No central station should make the mistake of expecting the industrial engineer also to be a solicitor for motor service. The central station can get a list of the power users in the territory. The industrial engineer then analyzes their present costs of energy, figures up their total cost, and what the cost of electric energy would be if served from the central station. He then figures the cost to the central station of supplying them with the required amount of energy and selects the most profitable prospects. These he gives to the solicitor, together with the information necessary to get the business, and the solicitor gets the contracts signed. He may or may not need the further aid of the industrial engineer to do this, but if he does need it he should have it. The engineer should not be expected to solicit. He is an engineer and not a salesman. Let the salesman find the prospective buyer and let him do the soliciting and get the contract, when the engineers have prepared the technical end for him. Always take pains to impress the prospect with the attention, time and professional services you are giving him, and especially show him how you are able to save him money and how you have arrived at his actual energy costs. If you do this you will have thoroughly satisfied customers who believe in you. Not only this, but the company will increase its profits as fast or faster than its revenue and any amount of energy released by replacing carbon lamps with tungstens can be readily sold at a greater profit than was realized from the carbon lamps. The tungstens will neither reduce the revenue nor the profit, but will result in a higher load-factor to the central station. You have already allowed the illuminating engineer to show what he can do. Why not give the industrial engineer an equal chance? He will without doubt show himself even more worthy of his service than has his elder brother.

TWO ELECTRICAL ADVERTISING NOVELTIES.

Near one of the Fifth Avenue stations of Chicago's elevated Loop an ingenious projecting-lantern advertising sheet has been arranged to attract the attention of those waiting on the platform opposite. Through a protected opening in a window the

lens of the lantern projects its rays against a mirror mounted several feet from the building and at such an angle as to reflect the image onto a screen on the wall below the window, where the rays come to a focus. This arrangement is made clear in the accompanying diagram. Use of the reflecting mirror extending beyond the building avoids the necessity for a window opening equal to the size of the screen, requires less room in the building and does away with the bright spot shown



Arrangement of Lantern.

by the lantern lens when the stereopticon is placed on the opposite side of the screen from the spectator, as would otherwise be necessary. Tendency to distortion caused by the angle at which the screen intercepts the pencil of rays can be prevented by arranging the stereopticon slide with a swing back paralleling it to the line of the building.

Another advertising novelty shown during the Electrical Show at the Coliseum represented a famous pair of washing-powder twins actually performing in all their pictured motions. The two figures, one wielding a scrubbing brush and the other bent over a wash tub, were silhouetted against a frosted glass framed by a box cabinet. Each twin was busily plying his task at the brush or tub, but with a striking synchronism that gave the clew to the ingenious scheme used to gain the effect. The stationary portions of the cut-out figures, legs and feet, tub, washboard, etc., were all pasted closely to the frosted glass, while the parts it was desired to have appear move were bent away from the shadow plane a small distance proportional to the amplitude of the motion. Behind the glass was an electric lamp rotated about its base by a small motor. With each revolution of the lamp the shadows of the raised portions of the little figures underwent a similar movement in the opposite direction as seen on the ground-glass plane, giving an extremely ludicrous effect viewed from the front of the screen.

MARKETING ELECTRICITY IN CHICAGO.

An instructive address on "The Market for Electrical Energy" was delivered at a well-attended meeting of the Electric Club of Chicago on Jan. 25 by Mr. E. W. Lloyd, general contract agent of the Commonwealth Edison Company. Mr. Lloyd gave a number of interesting facts in relation to the sale of electricity by his company in Chicago. He said that the contract department of the company embraces 140 men, of whom 100 are out "on the street" seeking business. The system of handling the business of the department was briefly described and the fact was mentioned that an effort is made to give prompt service after an order has been taken, often on the same day, where the company's wires are in the building occupied by the customer, as in the case of an apartment building. The work of the advertising department was referred to. An advertising committee of three, including Mr. Dana H. Howard, the advertising manager, holds weekly meetings and executes the policy of the company. Advertisements covering considerable space are inserted in the Chicago daily newspapers nearly the whole year round, at the rate of about two a week in each daily. There is also a great deal of magazine, program and direct-by-mail advertising.

In canvassing Chicago for new business the city is divided into thirty-five or forty districts for lighting business. Each of these is in charge of a solicitor, who often has an assistant. For motor business the city is divided into eight or nine districts, each having its own solicitor, as in the case of the lighting field. A distinct bureau is made of the sign business, and the city is divided into seven or eight districts for this purpose, with a man for each district, as in the other cases. Incidentally, the work entails a great deal of correspondence and sending out of literature and about 70,000 pieces of mail matter are handled each month by the department.

An interesting portion of Mr. Lloyd's address had to do with the new or comparatively new avenues for the use of electrical energy. He remarked that the investment in the central-station business of the country, exclusive of electric-railway work, has been at the rate of $125,000 a day during the life of the industry. The Chicago company owes much of its success to the great variety of its business, insuring a high diversity factor, which is extremely important. The growth of the business is shown by the fact that ten years ago the maximum load was 17,000 kw, whereas in December of last year the figure was 182,600 kw. Everybody knows that electrical energy is adapted for lighting and industrial purposes, but new ways and new processes are constantly being found to which it is especially adapted.

One of these is the sale of electricity for the operation of electric automobiles. This is a promising field, the importance of which is not fully realized. The speaker expressed himself as confident that in a few years the horse-drawn vehicle will be a comparative rarity in large cities. At the present time, according to the best figures obtainable, there are about 1300 electric vehicles in Chicago.

Another comparatively new outlet for electrical energy is supplied by the electric furnace, particularly as used for refining iron and steel. This class of apparatus is now thoroughly dependable, and it furnishes desirable business for the central station. Many successful electric furnaces are now in operation, the sizes varying from a few kilowatts to 1000 kw each.

Electric welding was mentioned as a development destined to assume increasing commercial importance. It is believed that there will be a great increase in the use of this process, with a corresponding demand for electricity. The operations now performed in a wide variety of manufacturing establishments by electric welding are most ingenious and interesting. They not only make for convenience, but also reduce in a marked degree the cost of manufacture of the various articles where the process is used.

Taking up the use of electricity in artificial ice making, Mr. Lloyd announced that a contract of this description had been signed in Chicago on the morning of his speech. It is only recently that electrical energy has been employed on a considerable scale in ice making and artificial refrigeration. The speaker said that it is the policy of one large ice company with which he is acquainted to abandon its ice houses as soon as they become dilapidated and manufacture its ice by the use of electrical energy. This class of business is exceptionally desirable to the central station, because it can be obtained off the peak. Usually arrangements can be made so that the artificial ice plant will be shut down between the hours of 4 and 8 p. m. in November, December, January and February of each year. The Commonwealth Edison Company has made an exhaustive inquiry into this important subject and has

found, for one thing, that between 50 and 60 kw-hours of electrical energy is required to produce a ton of ice.

In relation to electric drive in manufacturing establishments, Mr. Lloyd noted the careful manner in which estimates for this class of business are now made by the agents of the central-station company, many of whom are really experts in relation to the power requirements of a large number of industries. All classes of factories are supplied with electricity, and it is found that the advance estimates of probable requirements come remarkably close to the actual fact as determined later by meter measurements. The Commonwealth Edison Company has 11,000 motor customers and the total rating of industrial motors connected to its circuits is 188,000 hp. In view of the economies of central-station production, Mr. Lloyd believes that ultimately the private plant will disappear in Chicago. To many establishments electricity is supplied not only to drive motors, but also for heating in connection with soldering irons, furnaces, glue pots, etc.

As is well known, a large part of the output of the Commonwealth company is sold to transportation companies for the operation of surface and elevated railways. This business is still increasing, though not so rapidly, of course, as in former years.

Considering the smaller applications of electrical energy, both for industrial purposes and in the household, Mr. Lloyd took occasion to express obligation to the manufacturers of and dealers in appliances who further the sale of these devices. This work is appreciated by the central-station interests, he said. He spoke of various special campaigns to increase the volume of this small business—that is, small in the sense that each customer's requirements are small, but large in the aggregate, and particularly valuable in increasing the income per capita of the electric-service company.

The house-wiring campaign was cited, and it was said that up to date 2500 houses not before wired have been connected to the company's lines. The flatiron campaign, with which the readers of the *Electrical World* are familiar, was also mentioned. This resulted in the placing of over 10,000 electric irons. The pushing of tungsten clusters, particularly in stores and public halls, was briefly referred to. During the last three years about 16,000 of these clusters have been put out, each containing four 60-watt tungsten lamps. The campaign for special street illumination is actively pushed, and the result has been the placing of 1703 posts for ornamental street lighting, each supporting four 60-watt tungsten lamps. The sign business is important and brings in $500,000 in revenue yearly. There are now about 3000 electric signs on the company's circuits.

The company now makes no minimum charge, and of its 125,000 consumers about 70,000 are household customers. The number of watt-hour meters installed on customers' premises is 141,515, and in addition to these there are 47,418 Wright demand meters.

Mr. Lloyd referred briefly to the matter of rates. He said that the central-station output of electricity in Chicago is considerably larger than in any other city in the world. This may be taken as an indication of the average low rates which are made, and, indeed, this is the case. The rates for all classes of service are on file in the City Hall; they are designed to be as low as possible after allowing a reasonable return on the investment. The company does such a large business and has such a good diversity factor that it is enabled to sell electricity more cheaply, perhaps, than any other city not supplied with electrical energy produced by water-power. The rate schedule is based on the Hopkinson method.

In July, 1909, the company put into effect its wholesale schedule of rates for both lamp and motor business, and this schedule, with its low prices, has resulted in the securing of a large amount of business. A new modification of this wholesale schedule is about to be put into effect. This modification will be known as the "off-peak" contract, and under its terms an extremely low price for electric energy is made. The peak hours are from 4 to 8 p. m. during the months of November, December, January and February. On condition that the customer uses no energy during these hours the primary charge for the entire year is reduced to a point where it is slightly over one-half the primary charge as stated in the regular wholesale contract. No change is made in the secondary rate. There are many classes of business which can be taken on this "off-peak" contract, such as electric furnaces, grain elevators, some factories, etc.

In concluding, Mr. Lloyd spoke of the cordial spirit of co-operation in all of the departments of the Commonwealth company. From the president down, he said, every man was virtually a contract agent. All are keenly interested in the work of the contract department and help it in every way. The speaker showed some curves demonstrating graphically the growth of the business. Thus, in eighteen years the receipts of the company from the sale of electrical energy have increased from 50 cents per capita to $4.50 per capita. Including the railway load the receipts of the company are about $8.50 per capita. The total connected load is equal to about 9,000,000 50-watt equivalents. Of this about 6,500,000 50-watt equivalents are due to the energy sold for lighting and industrial power and heating. The remainder is the railway load.

Messrs. F. J. Postel, Albert Scheible, Harold Almert and W. S. Taussig asked several questions, and in answer to them Mr. Lloyd gave the following additional facts:

The number of customers who pay less than $12 a year out of the 70,000 residence customers is about 1700. In relation to the manner of preventing the consumer from using energy during the peak hours under the new "off-peak" contract, it was explained that on March 1 the customer gets a refund if he has complied with the terms of the contract. Printing attachments to the watt-hour meters will be relied upon to show that electricity is not used during the prohibited hours.

In relation to the general adoption of electric cooking, Mr. Lloyd said that in his judgment what is wanted in the average American family is some one device that will permit the preparation of a meal with a maximum demand for electricity not exceeding 1 kw. The aim should be to do all the cooking with a low maximum demand. The trouble is now that in the preparation of a number of dishes several different electrical appliances have to be used, and therefore the consumption of electricity reaches a maximum which renders electric cooking on a widespread scale impracticable for people of moderate means.

The last speaker was Mr. S. Phelps, of the Electric Fireless Cook Stove Company, of Buchanan, Mich., who remarked that he had devoted a great deal of study to the subject and had produced an electric "fireless" cook stove on which a meal for from five to nine persons could be prepared with the expenditure of less than 2 kw hours.

RIGHT OF ELECTRIC POWER COMPANY TO CONDEMN RIGHT-OF-WAY.

The statutes of the State of California provide that companies operating transmission lines, "electric heat lines, and electric light, heat and power lines," for public use, may exercise the power of condemning private property for a right-of-way. The Tuolumne Water Power Company was organized to operate an electric system for the transmission of electrical energy which was for sale to the public generally. The company brought an action to condemn a right-of-way over certain property, and it was held that the use for which the company wished the property was a public use within the meaning of the statute authorizing it to exercise the power of eminent domain.

One contention of the defendant was that the company was not entitled to acquire a right-of-way over his property by the exercise of eminent domain because it did not appear that the company was under any contractual obligation to furnish

electricity to any person for any purpose or that it had a franchise to furnish electricity to any counties, cities or villages through which the proposed line was to run. On this point the California Court of Appeals said: "It is not necessary that the plaintiff should have made a contract to furnish electric power before it had installed its plant and procured the right-of-way for its line. To prevent the plaintiff from exercising the right of eminent domain until it shall have obtained a franchise from some city or village would be to deprive it of the means by which it would be enabled to construct its works and put itself in a position to make a contract. The Legislature, representing the people, has provided that the right of eminent domain may be exercised for electric power lines for public use.

"At the present day the use of electric power, not only for lighting public streets and private houses, but also for the purpose of moving railroad cars, street cars and machinery for manufacturing purposes and for use in mines and smelters, has become so general that it is almost a necessity of our civilization. The courts would not be aiding the great enterprises of the West by adopting a narrow and restricted view of the meaning of the words 'public use,' as used by the Legislature and in our constitution."

Wiring and Illumination

EFFICIENCIES OF DISTRIBUTION.

Considering "Central-Station Economies" in a paper read at the recent Chicago convention of the Byllesby companies, Mr. Eugene Holcomb, manager of the Northern Heating & Electric Company, of St. Paul, Minn., had this to say of distribution:

"Stations located near enough to load centers to permit of generating current at distribution voltages show the least loss in the distribution system. The efficiency of such distribution should be 85 per cent to 90 per cent at maximum load. Stations not so centrally located with reference to the load and using alternating current generating at line voltage with one transformation to service lines should show a distribution efficiency of approximately 83 per cent. In stations where it is necessary to step-up from generator to line voltage, with two transformations to service line, the distribution efficiency would be approximately 68 per cent. The arrangement of the distribution system has as much to do with regulation and good service as machines and transformers themselves."

INSULATED WIRE RULES FOR NEW YORK CITY.

During last summer a conference was held in New York City on the subject of insulated wire, with respect both to the material of insulation and details of inspection tests. New York City was represented by Prof. George F. Sever, the New York Board of Fire Underwriters by Mr. J. C. Forsyth and the Wire Inspection Bureau by Mr. Hugh T. Wreaks. Messrs. W. A. Conner, W. S. Clark and Everett Morse appeared for the Rubber-Covered Wire Engineers' Association, and several of the wire-manufacturing companies had representatives present. As a result of the facts brought out at the conference the Department of Water Supply, Gas and Electricity of New York City has made a number of changes in and additions to the municipal rules and regulations relating to rubber-covered wire. The new rules will, in final form, go into effect on April 1, and in the meantime criticism is invited.

An addition to the rules requires that all tests required of rubber-covered wire shall apply to all wire at the time of manufacture as well as up to and including the time of installation. For a former requirement as to character of insulation is substituted another according to which the covering must consist of rubber or other approved compounds, homogeneous in character, adhering to the conductor and of a thickness not less than that given in an accompanying table.

Every length of completed wire or cable is required to be tested after ten hours' immersion in water at a temperature approximately 60 deg. Fahr. (15.5 deg. C.), and the results of insulation tests at different temperatures are to be reduced to a basis of 60 deg. Fahr. by using factors in the accompanying table; the tests to be made after an electrification of one minute and with a voltage of not less than 100 volts. The voltage tests and minimum insulation resistance are to be in accordance with the following table, which applies to completed lengths of rubber-covered wires and cables, 0-600-volt class:

Size.	Voltage Test for One Minute.	Megohms per Mile After 10 Hrs. Immersion and After Voltage Test.
14	1500	300
12	1500	250
10	1500	225
8	1500	200
6	2000	200
4	2000	150
2	2000	125
1	2500	150
1–0, 2–0	2500	125
3–0, 4–0	2500	100
250,000 to 500,000 cir. m.	3000	100
600,000 to 1,250,000 c. m.	3500	100
1,500,000 circ. mils	3500	75
1,750,000 circ. mils	3500	60
2,000,000 circ. mils	3500	50

Any length may be tested after thirty days' immersion in clear water and must show not less than 50 per cent of insulation resistance required after ten hours' immersion.

In testing for hardness of insulation the rubber or other approved compounds used as an insulation must, after the braid has been carefully removed, be sufficiently elastic to permit all wires smaller than No. 7 to be wrapped at least five times around a cylinder of diameter as specified and left so wrapped for twenty-four hours without injury to the insulation. The diameter of cylinder shall for No. 8-10 wire be equal to twice the diameter of wire measured over the insulation, after removing the braid, and for No. 11 and smaller wire equal to the diameter of wire measured over the insulation after removing the braid. In testing for softness of insulation the rubber or other approved compounds used as an insulation must present sufficient resistance to crushing or tension to withstand the following two tests. Samples while being prepared for these tests shall have a temperature between 50 deg. and 90 deg. Fahr. and shall be kept within these limits during the tests.

Test A.—A sample of wire of sufficient length for test, about 20 in., shall have the braid and insulation removed for about 2 in. at each end, leaving the braid and insulation otherwise on the sample. One end of the bare copper shall be fastened to a clamp on a shaft of the diameter given below, and a 10-lb. weight attached to the other bare copper end of the wire. The shaft shall then be revolved ten times in ten seconds, wrapping the sample in a close, even wind round the shaft. With the tension left on the sample, it shall then be immersed in water at a temperature of 60 deg. Fahr. for twenty-four hours, immediately after which time it shall, while still immersed, be subjected to 1500 volts alternating current for one minute and shall show an insulation resistance equal to at least half that required by the table given above. The shaft diameters are to be 170 mils, 190 mils, 275 mils and 375 mils respectively for Nos. 14, 12, 10 and 8 wire respectively.

Test B.—The sample to be tested shall have the braid carefully removed for at least 1 in. from one end. The wire itself shall be connected to one terminal of an electric circuit, of which a testing tool, described below, shall be the other terminal. This circuit shall have a potential of at least 100 volts

alternating current or 140 volts direct current and a resistance of at least 1000 ohms. The portion of the wire with the braid removed shall be placed on a flat surface and subjected to a pressure vertically applied by means of an edged tool of 5 lb. for fifteen minutes. The tool edge shall be sharp and the sides of the edge shall form an angle of 90 deg. with each other. During this period the tool edge when placed transversely to the insulation shall not sink through sufficiently to touch the copper wire and complete the electric circuit.

STREET STANDARDS AT MISHAWAKA, IND.

The little city of Mishawaka, Ind., some time ago adopted incandescent lamps on standards as the proper method of lighting the downtown section. The scheme employed is well

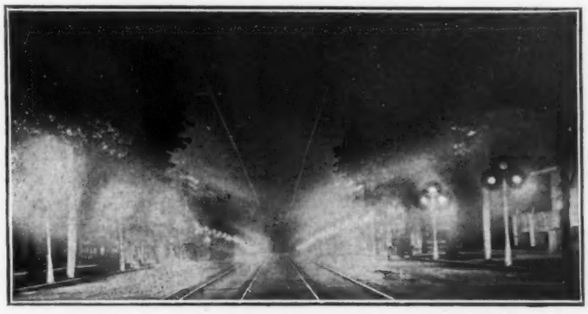


Fig. 1—Main Street, Mishawaka, by Night.

shown in the accompanying illustrations, the standards holding clusters of three or five incandescent lamps inclosed in opalescent glass globes. These standards supplement the regular arc

Fig. 2—Second Street, Mishawaka, by Day.

lamps which are suspended over the center of the roadway, as shown in Fig. 2, which shows the neat appearance of the standards by day. Fig. 3 is a view of the same street by night.

Fig. 3—Second Street, Mishawaka, by Night.

The closely spaced incandescent lamps show very plainly the value of dividing up the lighting units and also the value of placing the lamps near the ground. Compared with the once extolled tower lighting the frequent-cluster system is infinitely preferable. As will be noted from the engravings the five-lamp clusters are located at street intersections and the three-lamp clusters between. The standards are quite closely arranged, the posts being spaced in most places less than 50 ft. apart. This results in quite a high illumination for business streets, especially in a city the size of Mishawaka. The municipal light and water plant of the city purchases its energy from the Indiana & Michigan Electric Company, of South Bend, which has a hydro-electric station at Mishawaka on the St. Joseph River at Hen Island.

SPECTACULAR CENTRAL-STATION LIGHTING IN PORTLAND, MAINE.

Fig. 1 herewith shows a large electric sign used by the Portland (Maine) Electric Company in the most prominent plaza of the city, Monument Square. The sign is made up of 2-cp carbon-filament lamps and is located on the top of a mercantile building in a position which forces it upon the attention of

Fig. 1—Central-Station Sign in Portland, Me.

every person passing through the square at night. The square is also the principal street-railway transfer point of the city. There are about 350 lamps in the sign. In addition the company has illuminated the front of its new office building by 284 front and cornice lamps of 4 cp, wired on a 116-volt

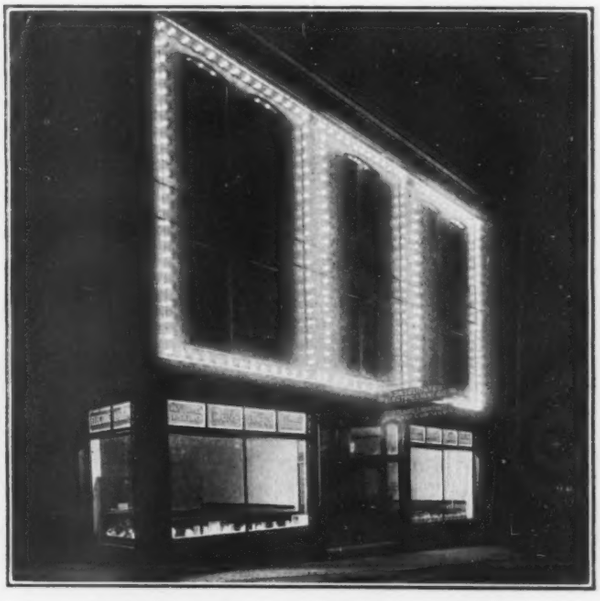


Fig. 2—Exterior Lighting of Office of Portland Electric Company.

multiple circuit. The display windows are also well lighted, the lamps in the latter case being concealed from the vision of passers-by. This installation is one of the most striking in New England and is illustrated in Fig. 2. The show-window lighting is effected by six 100-watt lamps in each case.

SPECTACULAR AND SPECIAL ILLUMINATION.

"Effective Illumination" was the title of a paper read by Mr. A. Larney, manager of the new-business department of the Oklahoma Gas & Electric Company, of Oklahoma City, at the recent convention of Byllesby companies in Chicago. The writer remarked that ten years ago an investment of $3,000 or $4,000 in an electrical display would have caused comment, but at the present time spectacular electrical displays are in operation which have cost more than $50,000 to install and which contain as many as 20,000 incandescent lamps.

Mr. Larney cited the instance of the first "chariot-race" sign erected in this country, which contained 6400 lamps and cost $20,000 to install, the flasher mechanism alone costing $4,600. The local central-station company granted a rate of 3 cents a kw-hour with a minimum of $125 a month. It was thought that the amount of energy consumed would amount to $300 or $400 a month, but, as a matter of fact, after thirty days' operation the amount of electricity used at the agreed rates was less than $88; and it is a fact that on this sign with over 6000 lamps the flasher had to be speeded up in order that the minimum guarantee of the contract might be reached. This fact is a striking demonstration of the comparative inexpensiveness of this method of publicity, which is also very modern and spectacular. Moreover, there is bound to be a great increase in the matter of ornamental lighting due to the recent movement for beautifying municipalities.

Referring to special illumination designed to increase the attractiveness of business thoroughfares, the author thinks that the best method of procedure is to select the most prominent business men who are members of the local business associations and call upon them to explain the excellent results that have been achieved in other cities by brilliant illumination of business sections. The question is one which may also be discussed in the local newspapers, and in time a deep interest, followed by a real demand, may be created. The new-business department of the central-station company should not allow the matter to rest, but should assume the initiative and present the matter to merchants in such a manner that it will receive their approval.

LETTERS TO THE EDITOR.

Converter Substations.

To the Editor of Electrical World:

SIR:—The letter by Mr. S. Q. Hayes in the first issue of January on the subject of converter substations leads me to offer this statement in order to express more clearly than heretofore the situation to which the controversy on the subject relates.

Mr. Hayes, in his article on "Modern Switchboard Practice," which was published in August, describes and illustrates a cross-section of a substation and presumably assumes credit for the layout as one originating with the manufacturing company with which he is connected. Again, in his subsequent reply of October, he says, quoting his own words: "The section shown was prepared from a preliminary drawing made under the writer's direction as a suggested arrangement of the station, and this design was accepted and adopted by the engineers of the Boston Elevated Railway Company, as it embodied their ideas as well as those of the writer." From the above he undoubtedly presumed to take credit to himself for the design of the station referred to.

As was clearly stated in my letter of November, the Boston substation was laid out by the company's engineers from their own observations of the Thirty-eighth Street substation and from plans of this substation which were furnished them at their request by the Brooklyn Rapid Transit Company. The Thirty-eighth Street substation was admitted by the Boston engineers to embody features superior, in their estimation, to those found in any substation which they had visited, some of these substations being referred to by Mr. Hayes in his last article. The evidence confirming these statements we are prepared to submit, if need be, to convince Mr. Hayes of his error.

Mr. Hayes illustrates and describes a substation, referring to a specific installation, and instead of giving credit where it is due assumes the originality of the schematic arrangement, although knowing from his own personal observation that it was an exact copy instead of, as he persistently states, resembling or being similar to a station already built and in operation.

I quite agree, however, with Mr. Hayes that each feature enumerated by the writer is in no way new or novel; but in no case, to my knowledge, has it been embodied in every detail as shown in the cross-section which was illustrated and which, as already stated, is a specific case. If this layout is ancient history, it seems to me useless to describe it, as Mr. Hayes evidently considered it of interest to do.

The success of any substation from an engineering or operating standpoint does not depend entirely on any one feature, but collectively on all which go to make up the complete installation. The designing of a substation is affected in many respects by the class of service furnished, the general operating practice as well as by local conditions.

I also agree with Mr. Hayes that any engineer who fails to make use of the ideas of others or of accepted standards, and refuses to take advantage of these ideas or improve on them, will soon be relegated to the class of "has-beens," but I do not agree with him in claiming originality or credit for ideas which are not his own.

The Thirty-eighth Street substation of the Brooklyn Rapid Transit Company was laid out entirely, even to the design and general arrangement of the apparatus on the switchboard, without any assistance from outside or from any manufacturing company.

Brooklyn, N. Y. A. K. MILLER.

Sir Charles Bright and the Atlantic Cable.

To the Editor of Electrical World:

SIR:—I regret that pressure of more immediate and important work has prevented my writing sooner in regard to certain remarks in the review which appeared in your issue of Oct. 20, 1910, on the abridged biography of my father, "The Life Story of Sir Charles Bright."

Let me first remark that those portions of the review to which I take exception are not at all in keeping with the review of the original two-volume edition, of which the present book is only an abridgement. Let me further state at the outset that I do not in the least mind an unfavorable review *per se* (and that in your columns is about the only one that has appeared regarding this book) except that class which suggests that I have been unfair to others, the fact being that I make a special study to be fair to everyone alike—even though I may be writing a biography of a particular man rather than a biography of several men. With these preliminary remarks I will now pass on to the unfavorable criticisms in more or less detail.

(1) The reviewer appeared anxious to lay it down that "throughout the enterprise (the Atlantic cable) Mr. Field was the guiding spirit of the company," and a resolution is quoted in proof.

I reply that the term "guiding spirit" is too general. Mr. Field was manager, and afterward managing director, but he failed to raise much capital in America, and my father and uncle secured most of it in this country, where the scheme had been under consideration some time previously, with Mr. Brett as the initiator. (I have the official list of shareholders.) Were I writing a full biography of Mr. Cyrus Field I might have quoted the resolution your reviewer does, but not if I were only writing one of the dimensions of this regarding my father, for I would point out that I omitted to quote precisely similar board of directors' resolutions acknowledging the services of my

father both as one of the projectors and as engineer-in-chief. These two resolutions are, however, hanging in my hall and (as purely personal matters) are prized very highly.

(2) Your reviewer considers that I have done Mr. Mullaly an injustice, and he is called "the Hon. John Mullaly, historian of the enterprise." In reply I would say that I was not aware that he was "the Honorable" (he does not style himself so in his book) and I challenge the suggestion that he was "the official historian of the enterprise." The latter would certainly be inferred from the titlepage of his book ("The Atlantic Telegraph," not "The Ocean Telegraph" as the reviewer has it), but I am not prepared to admit the fact, *nor much that the book contains*. The few small quotations that were made by me from Mr. Mullaly were not, as a matter of fact, from his book at all, but from reports by him in the *New York Herald*, where much that was in his book originated. To make footnote reference to the *New York Herald* has little purpose in a book that is published in London, where the same does not apply to the *Times*, back volumes of which are kept in numerous places; but this would have been done had the quotations been on a larger scale. The fact that Mr. Mullaly was on board the *Niagara* on behalf of the *New York Herald* was cut out in the abridged edition along with similar particulars regarding various other press representatives, all duly recorded in the original edition.

Reference is certainly made to Mr. Nicholas Woods as representing the *Times*, for the reason that his realistic account (in that paper) of the *Agamemnon* storm is largely drawn from. The scope of the book did not lend itself to naming the various private secretaries on board, or perhaps I might have been equally permitted to mention my father's private secretary, seeing that this was a biography of my father and not of Mr. Mullaly.

I think everyone knows pretty well that Mr. Cyrus Field introduced people on these early Atlantic cable expeditions—one was Mr. Mullaly and the other Mr. Everett. I have no doubt the former did what he was directed to do uncommonly well both in the *New York Herald* and in his subsequent book, but, having official documents at hand, I do not happen to be able to indorse much that Mr. Mullaly has written.

(3) The other grievance is that I have belittled Mr. Everett's share in the enterprise. Certainly anyone putting faith in Mr. Mullaly's book would be likely to arrive at that conclusion—at first sight, at any rate—but he might also arrive at the conclusion that perhaps the book in question was not very carefully prepared and was lacking in suitable perspective.

Thus, whereas the chapter consisting of biographical sketches—pages 26 to 50— leads off with eight *pages* about Mr. Cyrus Field, followed by five and one-half *pages* regarding Professor Morse (who had comparatively little to do with the actual enterprise), followed by three and one-half *pages* about Mr. Everett, only six *lines* are given to my father, and those six lines toward the end of the chapter, subsequent to similar "sketches" regarding his assistant engineers. It may be added that the only portraits given are very large ones of Mr. Field and Mr. Everett, the latter being practically a full-page portrait.

The fact remains, however, that my father was engineer-in-chief of the entire enterprise and was the only person officially recognized in that capacity. He had accordingly full control of all preliminary arrangements regarding the laying of the cable on both ships. (It was as engineer-in-chief of the undertaking that my father alone received the honor of knighthood, not as joint engineer of half the cable with someone else.)

The fact also remains that he was represented jointly on the *Niagara* by Messrs. Everett and Woodhouse, as stated on page 89 of this "Life" of my father. Mr. Everett (formerly of the United States Navy) was, in the first place, the ship's engineer—as stated by me—but owing to his intimate acquaintance with machinery took a leading part in that department as well as in the trials and the general arrangement of the paying-out apparatus for both ships. He had, however, never seen a cable laid before in his life, whereas Mr. Woodhouse had himself laid several cables in the Mediterranean Sea and elsewhere. For this reason he was in full charge of all that concerned the cable, while Mr. Everett was supreme in the matter of machinery, both carrying out the several instructions of the engineer-in-chief in much the same way as is necessarily done on a cable expedition of to-day where operations are conducted from more than one ship. Shared responsibility for the work as a whole would be impracticable.

I have much more I could say in regard to some of the details referred to, but I do not wish to do so unless necessary, if only for the sake of international amenities.

I will here only repeat that Mr. Field was managing director of the Atlantic Telegraph Company, and the biography says so. Further, Mr. George Saward was secretary immediately under him rather than anybody else. Mr. Everett was one of the chief assistant engineers, and the biography says so; but let me again remark that in the first instance the book was a biography of my father, the only official engineer-in-chief to the enterprise—not of the distinguished Americans named. On the other hand, Mr. Mullaly's book was entitled "The Atlantic Telegraph" and professed to be a general history of the enterprise as a whole and not in relation to any one man, or certain two or three men, in particular.

If it pleases those in America to claim everything for their countrymen, they are, of course, at liberty to do so, though not borne out by official records.

Caxton House, CHARLES BRIGHT.
Westminster, London, England.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Braking of Single-Phase Commutator Motors.—F. RUSCH.—The first part of a paper in which the author discusses whether the different types of single-phase commutator motors can be braked by driving them from the outside in such a way that they work as generators and return energy to the network. He first discusses the series motor and gives a mathematical theory showing that the current in the motor is the sum of a forced current of the same frequency as the e.m.f. and of a free oscillation which becomes practically zero after a very short time. The latter oscillation need not be taken into consideration as long as the machine operates as motor, but it is different when it operates as generator, since the free oscillation then tends to become infinitely large in time. This yields a braking torque which tends to become infinitely large and cannot be regulated. Formulas are given for the induction coefficients for sinusoidal fluxes and fluxes of other shapes. The paper is to be concluded, when the repulsion motor and the Winter-Eichberg motor are to be taken up.—*Elek. u. Masch.* (Vienna), Jan. 1.

Static Balancer.—C. C. HAWKINS.—A theoretical paper presented to the (British) Institution of Electrical Engineers on the theory of the static balancer used in connection with a single generator feeding energy to a three-wire network. The author first considers the simple two-phase case, and calculates the divergence of the potential of the third wire when the latter is disconnected from the balancer. He then determines the distribution of the current and the amount of divergence of the potential of the third wire when the latter is connected to the balancer.—Lond. *Electrician*, Jan. 13.

Voltage Between Segments.—F. Punga.—In the design of high-speed direct-current generators and motors and synchronous converters the designer must be careful to maintain the voltage between adjoining segments below a permissible limit. E. Thomson, Pohl and M. Walker have devised windings by which the voltage between segments is reduced. Another winding devised by the present author is a double-parallel winding, the normal equipotential connections of which are

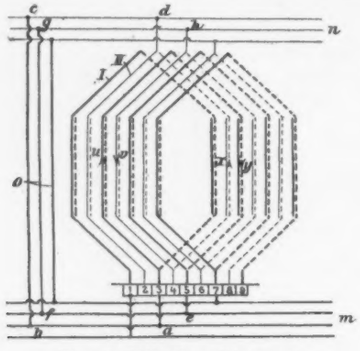


Fig. 1—Winding Diagram.

arranged one-half on one side (*m*) and the other half on the other side (*n*) of the armature. (Fig. 1.) Some or all of the different equipotential rings of one side are connected (by *O*) with the corresponding equipotential rings on the other side, so that in this way the maximum voltage between segments is reduced to one-half. A special arrangement is devised by which the no-load losses which otherwise become unduly large can be reduced.—*Elek. u. Masch.* (Vienna), Jan. 1.

Lamps and Lighting.

Photometric Units.—E. B. Rosa.—A long paper giving a systematic discussion of the mathematical and physical relationships of the various photometric quantities. The author gives a general discussion and a derivation of formulas for a point source, distinction between luminous flux and energy, definition of intensity for unsymmetrical sources, unit disk, extended source (circular disk), infinite plane, infinite cylinder, unit length of cylinder, case of large sphere, reciprocal relations, hollow sphere, luminous flux within an inclosure. He then gives a summary of the photometric relations discussed before in detail, a few problems for illustrations and a collection of the different fundamental formulas.—*Bull. Bur. of Standards,* Vol. 6, No. 4 (November, 1910).

Storage Batteries for Portable Photometers.—A. P. Trotter.—The criticism has recently been made that in connection with photometer tests a storage cell cannot be relied upon to within 1 per cent for more than a few minutes at a time. The author has tested a storage battery of British make by an arrangement which provided for making contact for ten seconds once a minute. This is about the time occupied in making one photometric measurement. The battery which was tested had been idle for some weeks, probably partially discharged, was connected through 8 ohms and a potentiometer to the mercury troughs and discharged with the above arrangement for about 45 hours. Ordinary terminals and connectors were used without soldering or special cleaning. The volts during discharge were measured ten times during this period and were found to fall regularly from 3.945 to 3.924, or one part in 1000 per hour. The battery was charged and discharged five times, and after having been charged again it was in good condition and the former test was repeated, when the average fall was 0.05 per cent per hour.—Lond. *Electrician,* Jan. 13.

Manufacture of Metallic Filaments.—A note on a recent British patent (7331, Jan. 5, 1911) of H. Madden and W. G. Houskeeper. A heating process specially adapted to filaments prepared by squirting of tungsten paste through a die consists in subjecting every portion of the continuous filament to different degrees of heat successively by passing it through a series of contacts which cause currents of different values to flow through the portions between different contacts.—Lond. *Elec. Eng'ing,* Jan. 5.

Moore Tube Lamp.—M. Leblanc, Jr.—An illustrated summary of the properties and the present status of the Moore tube lamp.—*La Lumière Elec.,* Jan. 7.

Generation, Transmission and Distribution.

British Power-Plant Statistics.—The annual statistical table of the different electric generating companies in existence and in the course of construction in Great Britain, with data on their equipment and maps of their areas. The total connections recorded in the table are now approximately 225,200 kw, compared with 196,960 kw a year ago, an increase of nearly 15 per cent.—Lond. *Electrician,* Jan. 13.

British Energy Supply.—A long and profusely illustrated article on the electric energy transmission and distribution systems to collieries on the northeast coast of England. The largest station is at Carville, which has a total maximum equipment of 52,000 hp, divided up into eight turbo-generating units. These deliver three-phase currents at 5750 volts, 40 cycles, to the station busbars, and for purposes of transmission step-up transformers raise this pressure to 22,000 volts. There are quite a number of other plants in this district and the total rating of the plants now in service exceeds 100,000 hp, this total including the new Dunston station, which has a rating of 32,000 hp in three turbo units. The transmission system includes long stretches of underground cables and overhead bare wires. The employment of the Merz-Price system of relays has made possible the interconnection of a number of generating stations situated at varying distances from each other and the interlinking of underground cable and overhead transmission lines operating at extra-high voltage. The feature of the Merz-Price protective gear is the certainty with which it will isolate a faulty section of line from both ends, leaving the other portions of the system entirely free from fault. A table gives details of the different overhead lines, of which five lines are operated at 20,000 volts, four lines at 11,000 volts and five lines at 6000 volts. Full descriptions are also given of substations and colliery installations. A reliable supply of energy is now guaranteed to the industrial plants in this district, and as a consequence not only have old private plants been "scrapped" in large numbers, but a number of quite modern plants have already been removed in spite of the loss of capital thereby involved.—Lond. *Electrician,* Jan. 13.

Ward Leonard Control for Rolling Mills.—A note on a recent British patent (22,110, Jan. 5, 1911) of Siemens Brothers Dynamo Works, Ltd. (Siemens-Schuckert Werke). In a rolling mill or other plant controlled on the Ward Leonard system the main motor is given a series characteristic (that is, large turning moment with moderate armature current), and yet can be reversed without reversing heavy currents. This is effected by connecting the motor-field coils in series with the generator-field coils to a direct-current supply at constant voltage. The field strengths of both are also influenced by an auxiliary generator, the voltage of which depends upon the armature current of the main motor and can also be regulated by hand. When the load increases the main motor field is strengthened automatically and the generator field weakened by the influence of the auxiliary machine.—Lond. *Elec Eng'ing,* Jan. 12.

Traction.

Electromagnetic Rail Brakes.—R. Naumann.—The first part of an article in which the author describes experiments made with electromagnetic rail brakes under different conditions of the rails. The paper is to be concluded.—*Elek. Zeit.,* Jan. 12.

Corrugation of Rails.—J. H. Briggs.—The author lays stress upon the fact that any theory of corrugation must admit of the cars taking up the vibration synchronously for the corrugations to persist, and he describes experiments showing that the climbing action of the wheel on the rail permits such periodic movement.—Lond. *Electrician,* Jan. 13.

Installations, Systems and Appliances.

Automatic Battery-Charging Switch.—An illustrated description of a new automatic switch of English make for battery circuits. The connections and details of arrangement are shown in Figs. 2 and 3. Use is made of two coils, one wound with fine wire on an iron core and the other consisting of a large-section copper rod arranged as a solenoid. The former of these is carried on an arm inside the solenoid. This arm is pivoted and at the other end from the coil carries a forked switch dipping into two mercury cups. The horseshoe permanent magnet surrounds both coils. From Fig. 2 it will be noticed that the solenoid is cut into or out of circuit by the mercury switch, while the fine-wire coil is permanently connected across the mercury cups, being short-circuited when the fork switch is down. The switch, as a whole, is connected in series with the generator and battery, and if the number of cells exceeds sixty-four an adjustable resistance is placed in the fine-wire circuit. With the switch in the normal "off" position the fine-wire coil rests in close proximity to the lower pole of the permanent magnet, the south in this case. When the battery and generator are switched on to the cut-out, if the e.m.f. of the battery exceeds that of the generator, a current flows through the fine-wire winding in such a direction as to produce a north pole at the outer end of the core, which is, therefore, attracted downward and the bridge piece is held clear of the cups. When the e.m.f. of the generator rises above that of the battery this polarity changes and when the excess voltage is about 10 per cent the repulsion of the south pole and attraction of the north pole are sufficient to cause the lever to swing up and the switch then enters the mercury cups. As the attraction of the upper pole increases as the movement proceeds, the action is quite decided. The fine-wire coil is now short-circuited, but the main current flows through the solenoid in such a direction that the resulting flux maintains the polarity of the iron core in the potential coil. If for any reason the generator voltage drops below that of the battery the cut-out at first operates by gravity and breaks circuit with the current at zero. At the same time the fine-wire coil is cut in again and by its attractive action prevents any tendency to hunt or for the arm to float either in making or in breaking the circuit. Should the current reverse, the same operation occurs, the circuit being broken when the current is zero, so that there is no harmful sparking.—Lond. *Electrician,* Jan. 13.

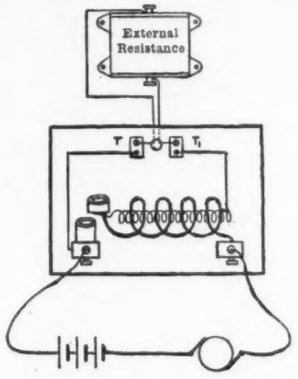


Fig. 2—Diagram of Connections of Automatic Battery-Charging Switch.

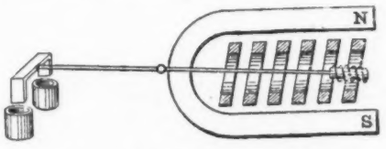


Fig. 3—Arrangement of Coils and Mercury Cups in Automatic Battery-Charging Switch.

Limit Meter.—A note on a recent British patent (28,947, Jan. 5, 1911) of E. T. Ruthven Murray for various forms of an instrument termed an "assessmeter." The object of the device is to indicate the maximum demand which a consumer may make. Should the demand exceed the limit indicated, a dimming switch comes into operation, and the consumer may either decrease his demand or increase his limit by moving the indicator on the assessmeter. He cannot, however, decrease the limit indicated. A scale of fixed charges per quarter is fixed on the meter, and on increasing the limit of current the indicator points to a higher charge or assessment. The instruments described work on the hot-wire or other principles in which the heating effect of the current is employed.—Lond. *Elec. Eng'ing,* Jan. 12.

Double Tariff.—A. MOHL.—An article in which the author describes a new double tariff in which the change from one tariff to another tariff is not made by a clock at a certain time, but by a relay whenever the current rises above a certain predetermined limit. The object is to make the double tariff available for small consumers, since a current relay is cheaper than a clock and does not need regular attendance.—*Elek. Zeit.,* Jan 12.

Electricity in Agriculture.—H. OSTEN.—The first part of an article in which the author gives statistical data on agriculture in Germany, including the suitability of ground for different agricultural purposes in different provinces, questions of ownership, etc. He emphasizes that such commercial questions are of fundamental importance to decide what the future of electricity in agriculture will be.—*Elek. Zeit.,* Jan. 12.

Wires, Wiring and Conduits.

Graphical Determination of Overhead Wires.—A. BLONDEL.—Without changing the principle of his old diagram for the direct calculation of overhead wires, the author presents it now in a somewhat different form. For the sake of convenience it is given in three different diagrams.—*La Lumière Elec.,* Jan. 7.

Network Plans.—C. W. RYCROFT.—The author points out that it is essential for the efficient working of a distribution department that it should possess a set of network plans of cables laid and contingent records on which absolute reliance can be placed, and which should combine neatness and legibility with correct and full information. This is often neglected in the first year or two of a new central station, and such neglect causes great trouble later on. The author shows how such plans and diagrams can best be arranged. The article is fully illustrated.—Lond. *Elec. Review,* Jan. 13.

High-Tension Cables.—L. LICHTENSTEIN.—A translation of his German paper, recently abstracted in the Digest, on the latest developments in the manufacture of high-tension cables.—Lond. *Electrician,* Jan. 13.

Electrophysics and Magnetism.

Power Fluctuations in Alternating-Current Circuits.—B. GLATZEL.—An illustrated description of an arrangement for demonstrating experimentally the energy fluctuations during one period in an alternating-current circuit. For demonstration purposes use is made of a wattmeter giving deflections of the needle to both sides. While its current coil is permanently inserted in the alternating-current circuit the voltage coil is connected to it momentarily only at certain instants by means of a Joubert disk, so that the reading of the wattmeter gives the instantaneous power for the conditions existing at any instant.—*Phys. Zeit.,* Jan. 1.

Volume Ionization Produced by Light.—F. PALMER, JR.—Lenard has formerly shown that in addition to the well-known Hallwachs effect, or ionization produced at a charged metallic surface when struck by ultra-violet light, there exists also a volume effect which takes place in the gas itself. The present author has studied this volume ionization produced in different gases by light of extremely short wave-lengths. It is shown that comparatively large currents may be obtained in air at atmospheric pressure when extremely short wave-lengths are used as a source of illumination. Using a discharge tube filled with hydrogen as a source of light and a screen cell filled with oxygen at various pressures ionization curves have been obtained in air, oxygen, hydrogen and nitrogen. The ionization in air, oxygen and nitrogen is considerable. That in hydrogen is exceedingly small. The currents obtained for all gases are large compared with the values of most other observers. The

power of ionization increases greatly with decrease in wavelength of light, at all events in the region below $\lambda = 1850$.—*Phys. Review,* January.

Magnetic Alloys from Non-Magnetic Elements.—A. A. Knowlton.—An illustrated paper on the preparation and properties of Heusler alloys. The precautions to be observed in

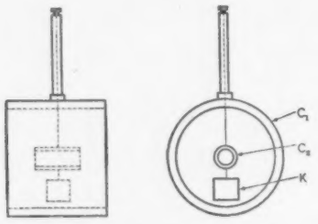


Fig. 4—Electrodynamometer.

the preparation of the alloys are long heating, the use of silica-free crucibles and molds, casting in hot molds, annealing to the upper limit of transformation with subsequent quenching. The magnetic examination shows the favorable effect of annealing at the upper limit of transformation and the unfavorable effect of annealing at the lower limit. The transformation temperature depends upon the composition. Photographic examination shows the close dependence of the magnetic properties upon the crystalline structure.—*Phys. Review,* January.

Units, Measurements and Instruments.

Absolute Measurement of Electric Quantity.—B. McCollum.—An illustrated description of a new method for the absolute measurement of electric quantity. The author uses a type of electrodynamometer which, when used to measure the electrochemical equivalent of silver, appears to be free from the objections to the ordinary types of electrodynamometers. The instrument consists essentially of a relatively large fixed coil C_1, Fig. 4, with its axis in a horizontal position, at the center of which is suspended the movable coil C_2 with its axis parallel to the fixed coil when at rest. Attached to the movable coil is a cylinder K, of some homogeneous material, placed with its axis vertical and coincident with the axis of suspension. This

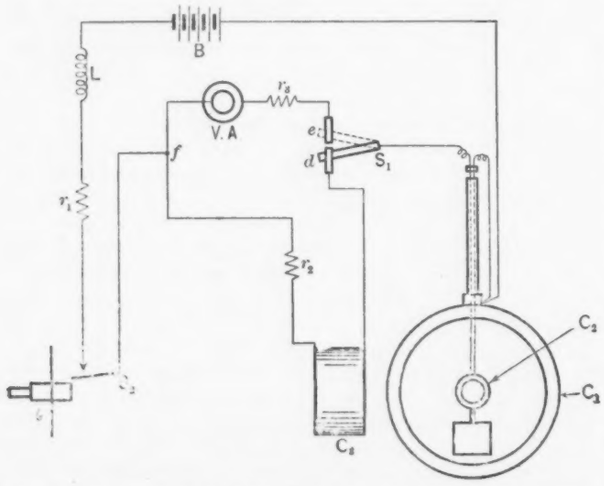


Fig. 5—Arrangement of Apparatus for Measurement of Electrical Quantity.

cylinder is of very regular dimensions and has a moment of inertia as large as, or larger than, that of the movable coil. If these two coils be connected in series in proper relation and a current sent through them there will exist a couple tending to hold the movable coil with its axis parallel to that of the fixed coil, and if the movable coil receive an angular displacement and be released it will oscillate as a torsion pendulum. If now the form of the field due to the fixed coils be such that the restoring couple is directly proportional to the angular displacement the period of the oscillation will be independent of the amplitude and there will be obtained in effect a torsion pendulum subject to the laws of a damped oscillation. The current can be measured easily and exactly, but the quantity of electricity may be obtained directly without any knowledge of the value of the current. This fact may often be of advantage where the electrochemical equivalent of silver or other metals is being determined or, in other cases, where the time integral of current is required. A typical arrangement of the apparatus is shown in Fig. 5. B is a battery supplying current through the regulating resistance r_1 to the coils C_1 and C_2 of the electrodynamometer connected in series. S_1 is a single-pole, double-throw switch which at starting is thrown over to the terminal d so that the current is made to flow through the control C_3, which holds the movable coil C_2 at any suitable initial deflection (which need not be measured). The resistance of the circuit df should be previously adjusted nearly equal to that of the circuit ef, which contains the voltammeter VA, and the terminals d and e should be so adjusted that the switch S_1, when thrown over, makes contact with e an instant before breaking the current at d. When ready to start the experiment the switch S_1 is quickly thrown from d to e, which starts the current in the voltammeter circuit ef and at the same time breaks the circuit of the control coil C_3, thus releasing the movable coil C_2, and the vibration begins. The instrument should then be permitted to swing freely for a sufficient length of time to permit the deposition of enough silver for accurate weighing, during which time the number of complete vibrations of the movable coil is counted. When it is desired to stop the experiment a reading is taken of the last maximum deflection at the end of n_0 complete vibrations, and about a quarter period later the current is switched off and at the same instant the position of the movable coil in its cycle and also its direction of motion are noted.—*Bull. Bur. of Standards,* Vol. 6, No. 4 (November, 1910).

Mica Condensers as Standards of Capacity.—H. L. Curtis.—A long paper in which the author discusses the methods of measuring capacity, the external conditions which affect the capacity, the stability of mica condensers and the relationship between the different apparent capacities. The various methods for measuring capacity with alternating current and direct current are discussed and the best methods to use when mica condensers are to be measured are indicated. A method is given by which the temperature coefficient of a mica condenser may be made very small, at most a few parts in 100,000 per degree. The effect of changes of the atmospheric pressure upon the capacity is shown to be small, though in some cases it is not negligible. An explanation of the change of capacity with voltage which is observed in the case of silvered-mica condensers is offered. Condensers which are kept in a vacuum and maintained at constant temperature can be relied upon to a few parts in 100,000. Such condensers are somewhat more stable than condensers which are maintained at constant temperature but subjected to ordinary fluctuations of atmospheric pressure. Condensers exposed to the ordinary changes of room temperature show unaccountable variations of the capacity of two or three parts in 10,000. It is shown that, taking the measured values of the specific resistance of mica and paraffin, Maxwell's theory of a stratified dielectric does not account for the absorption actually observed in the case of a mica condenser. This theory is then applied to alternating-current measurements and it is shown that, according to this theory, the loss of energy per second in the dielectric is nearly independent of the frequency, whereas measurements show that the loss of energy per cycle is almost independent of the frequency. The conclusion is drawn that this theory alone will not explain the phenomena of absorption. The capacity of a condenser with alternating current of infinite frequency is shown to be the same as the capacity with direct current when the time of discharge is infinitely short. This capacity is called the geometric capacity, since it is a function of the dimensions and dielectric constants of the dielectrics.—*Bull. Bureau of Standards,* Vol. 6, No. 4 (November, 1910).

Mutual Inductance.—F. W. Grover.—A mathematical paper in which the author gives a formula for the mutual inductance

of the two parallel coaxial circles in terms of hypergeometrical series. The author's formula is a modification of that of Mathy and gives results agreeing closely with the formulas of Maxwell and Nagaoka.—*Bull. Bur. of Standards*, Vol. 6, No. 4 (November, 1910).

Telegraphy, Telephony and Signals.

Wireless Telegraphy.—H. POINCARÉ.—The first part of a highly theoretical paper on various questions relating to wireless telegraphy. In the present instalment the author deals with the predeterminations of the wave-length and the damping coefficient on an exciter of given form by Fredholm's method and indicates several generalizations of this method. An application is made to the determination of the distribution of electricity in a conductor placed in a given field.—*La Lumière Elec.*, Jan. 7.

Impact Excitation Patent.—A note stating that after litigation extending over a period of nearly three years a patent has been granted in Germany to Baron E. von Lepel for his wireless-telegraph oscillation generator comprising a series of metallic disks separated by rings of paper. The grant was opposed by the Gesellschaft für Drahtlose Telegraphie (the owner of the Telefunken system), but the final result after appeal is that the Lepel patent has been granted, while a subsequent application by the Gesellschaft für Drahtlose Telegraphie describing a similar device has been refused. This is said to be the fundamental patent of the Telefunken system, which is almost universally employed in Germany.—Lond. *Elec. Eng'ing*, Jan. 12.

Impact Excitation.—G. W. NASMYTH.—A first paper on experiments in impact excitation (Strosserregung) for producing high-frequency oscillations for wireless telegraphy. In the present paper the author discusses the characteristics of short arcs between metallic electrodes. For electrodes of the short arc oscillation generator copper is found to be the most satisfactory material, and with plates not more than 0.25 in. thick water cooling is unnecessary. The kind of paper used for separating the plates is immaterial, but much difficulty attends the use of mica. Charring the paper and breaking a short-circuit across the arc in oil is the most effective method of starting the arc when only a low voltage is available. Connecting arcs in parallel, each with its own choke coil and inductance, gives double power for the same applied voltage and has other advantages over series connection. The Lepel arc has a falling characteristic much steeper than those of the Duddell or Poulsen arcs and operates on smaller currents. The separation of the two characteristics obtained with and without oscillations is much greater for the Lepel arc than for the others. The characteristics for increasing arc-lengths lie one above the other at large currents, but at small currents the order is reversed. This is found to be due to marked maxima in the voltage across the arc which occur at smaller arc-lengths as the current is increased. The maxima in the voltage are due indirectly to the variation in the arc capacity, which is quite large on account of the small distance between the plates which form the electrodes. The maxima in the voltage are caused by corresponding minima in the oscillations produced by the arc. The capacity of the arc and that of the condensers are in parallel, but the inductance in series with the condensers partly neutralizes the effect of their capacity and makes the capacity of the arc more important. Decreasing the inductance of the main circuit has the same effect on the voltage as increasing the capacity of the arc. The minima in the oscillations and corresponding maxima in the voltage across the arc occur because for certain values of sparking, potential, arc current, capacity and inductance the time of discharge is a minimum compared with the time of charge. The minima in the oscillations furnish conditions especially favorable for strong quenching of the oscillation and for impact-excitation effects. Experiments with a Braun cathode-ray tube show that the maximum instantaneous or sparking potential for the arc increases as the arc current is decreased. The sparking potential is especially high in the region of the minimum. This is chiefly a capacity effect also, but is similar to certain phenomena in spark-gap excitation in which the variation in the resistance of the arc plays a more important part.—*Phys. Review*, January.

Impact Excitation.—G. W. NASMYTH.—A second paper on experiments in impact excitation. The author discusses the intensity of the Lepel arc oscillations as a function of the arc current, capacity and inductance. The intensity of the oscillations in the condenser circuit of the Lepel arc is in general two or three times as great as the direct current supplied to the arc by the generator. The intensity of the oscillations increases with the capacity very rapidly at small arc currents and more slowly at larger currents. Inductance and resistance decrease the intensity of the oscillations. As the arc current is increased at constant capacity the oscillations fall rapidly to a minimum and then increase slowly, passing through a maximum to a secondary minimum. As the capacity is increased or the inductance decreased the minima and maxima in the oscillations shift into the region of larger arc currents. A linear relation exists between the arc current for minimum oscillations and the capacity. The range through which oscillations can be obtained shifts with the minima. The explanation for the minima in the oscillations is found in the effects of the energy stored at the instant the gap breaks down. The energy stored in the inductance is large for large arc currents, while the energy stored in the capacity is large on account of the increased sparking potential at small arc currents, giving a minimum at intermediate arc currents. The condition of minimum oscillations is most favorable for strong quenching and impact excitation. The direct-current voltage across the arc increases with the capacity of the condenser circuit. The increase is most rapid at small arc currents, so that the form of the voltage-current characteristics is changed by the capacity in parallel. The capacity of the arc is added as if it formed a parallel circuit to the capacity of the condenser circuit for the intensity of the oscillations, but not for the frequency.—*Phys Review*, January.

Impact Excitation.—MOSLER.—An English translation of his recent German paper on the discharge frequency of the Wien short-spark generator and its dependency upon current, capacity and inductance.—Lond. *Electrician*, Jan. 13.

Wireless Detectors.—S. M. POWELL.—The conclusion of his illustrated article on the theory and practice of wireless detectors as at present used. The author concludes that the order of sensibility of detectors recently quoted by Fleming, namely, oscillation valve, magnetic detector, electrolytic and carborundum, is by no means exhaustive or even universally true, so far as it goes. The writer's experience agrees rather with the order, thermal, electrolytic, magnetic and rectifying types, the "audion" sensibility being variable, but probably between that of the electrolytic and magnetic types under the most favorable conditions. It is thought impracticable to enunciate dogmatically an order of merit for the many forms of detectors now available. The following points should rather be taken into consideration: automatic decoherence, adjustability, tuning, quick acting, sensitivity to weak signals and to strong signals, resistance, external effects (vibration and field), ease of construction and erection and ease of procuring material. The different detectors have their own special fields for special purposes.—Lond. *Elec. Review*, Jan. 13.

Detectors of Electrical Oscillations.—L. W. AUSTIN.—An article giving the results of measurement of the comparative sensitiveness of some common detectors of electrical oscillations. The electrolytic detector, the Perikon detector, the magnetic detector, the Fleming vacuum-valve detector and the audion of De Forest were tested.—*Bull. Bureau of Standards*, Vol. 6, No. 4 (November, 1910).

Wireless Telegraphy.—O. JENTSCH.—The author discusses the part Germany has taken in the development of wireless telegraphy and emphasizes especially the present general use of Braun's oscillation circuit.—*Elek. Zeit.*, Jan. 12.

Miscellaneous.

Magnetic Properties of Iron-Silicon Alloys.—S. Guggenheim.—A translation of his German lecture giving the results of tests of iron-silicon alloys with varying percentages of silicon. The initial values of the permeability decrease at first with an increase of silicon, but they afterward increase together. The maximum values of the permeability behave similarly. For high inductions, say, from 14,000 upward, for a given strength of field the permeability decreases more quickly with an increase in the percentage of silicon. In general terms it may be said that up to about 1.8 per cent of silicon the *B-H* curves rise more slowly with an increase in the amount of silicon, but they rise quite steadily till the highest inductions are reached. From 1.8 per cent to 5 per cent of silicon the *B-H* curves rise more steeply with an increase in the amount of silicon, but the bend in the curve is much more pronounced, so that at the higher inductions a decrease in the permeability accompanies an increase in the percentage of silicon.

The accompanying table gives an outline of the figures relating to samples containing 0.194 per cent and 4.789 per cent of silicon, the last column showing the increase in the latter as compared with the former case, expressed as a percentage of the former. This table shows clearly that for the sample with

EFFECT OF SILICON ON PERMEABILITY.

H	B Si=0.194%	B Si=4.789%	Percentage Increase or Decrease.
2	2,850	7,620	+168
5	8,350	11,660	+ 40
10	11,490	13,060	+ 14
20	13,670	13,860	+ 1.4
50	15,580	15 040	− 3.5
100	16,950	16,140	− 4.8

the larger percentage of silicon the increase in the values of the permeability for the lower values of *B* (that is, over the range employed for the greater proportion of every-day work) is very great, whereas for higher values of the induction the permeability is slightly reduced by the presence of a greater proportion of silicon. The point where the permeability of the iron with a high silicon content begins to be less than that of one with little silicon may be taken as being in the neighborhood of $B = 13{,}000$ to 14,000. Similar results are obtained from an examination of the hysteresis losses. The results are shown in Fig. 6, where the hysteresis losses are seen to be a maximum with Si = 1.8 per cent and finally fall to very low values at Si = 5 per cent. For well-known reasons a satisfac-

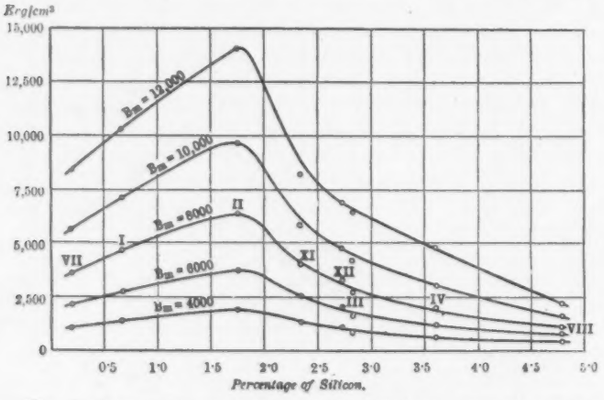


Fig. 6—Curves Showing the Relation Between the Hysteresis Losses per Cycle and per Cubic Centimeter in Ergs, and the Percentage of Silicon in the Alloy.

tory alloy containing more than 5 per cent of silicon cannot be obtained. But with 4.8 per cent of silicon the hysteresis and eddy-current losses amount to 1.23 watts per kilogram (at 60 cycles), which is much less than for the best sheet iron. Iron-silicon alloys containing 4.8 per cent silicon are of extraordinary hardness, but if they can be rolled (which is considered possible by special heat treatment) they will be very valuable for electrical purposes.—Lond. *Electrician*, Jan. 13.

Book Reviews.

Electric Railway Transportation. Philadelphia: American Academy of Political Science. 4to, 202 pages, illus. Price, paper covers, $1; cloth, $1.50.

The present volume, which is the first issue for 1911 of the bi-monthly *Annals* of the American Academy of Political and Social Science, forms an important contribution to electric traction with respect to traffic and financial problems now of live interest and to the subject of the public regulation of electric railways. The Academy has in the past considered similarly great questions of the day relating to political economy and sociology, and the standing of the body gives to its publications great weight, abroad as well as at home. For the present work the collaboration has been secured of the leading authorities in this country on the various subjects treated, as will be seen in the following list of contents:

"The Urban Transportation Problem," by Mr. Bion J. Arnold; "The Decreasing Financial Returns Upon Urban Street-Railway Properties," by Dr. Thomas Conway, Jr., University of Pennsylvania; "The Depreciation Problem," by Mr. William B. Jackson, Chicago; "Methods of Increasing the Efficiency of Surface Lines in Large Cities," by Williston Fish, Chicago; "The Investigation of Traffic Possibilities of Proposed Subway Lines," by Mr. William S. Twining, New York; "Possibilities of Freight Traffic on Interurban Lines," by Mr. Frank S. Cummins, Des Moines, Ia.; "Express Business on Interurban Lines," by Mr. A. Eastman, Kingsville, Ontario; "Economic Factors in the Selection of Cars for Urban Service," by Mr. Samuel M. Curwen, Philadelphia; "Relation of the Electric Railway Company with Its Employees," by Mr. C. D. Emmons, Fort Wayne, Ind.; "The Strike Problem Upon Electric Railways," by Mr. Daniel T. Pierce, New York; "Educating the Public to a Proper Appreciation of Urban Street-Railway Problems," by Mr. A. W. Warnock, Minneapolis, Minn.; "The Presentation of Interurban Problems to the Public," by Mr. A. D. B. Van Zandt, Detroit, Mich.; "Valuation of Intangible Street-Railway Property," by Mr. Frank R. Ford, New York; "The Indeterminate Permit as a Satisfactory Franchise," by Mr. William Osgood Morgan, New York; "State Supervision of Electric Railways in Wisconsin," by the Hon. B. H. Meyer, chairman Interstate Commerce Commission; "The Fruits of Public Regulation in New York," by the Hon. Milo R. Maltbie, Public Service Commission of New York; "Supervising Engineers and Street-Railway Service," by Mr. George Weston, Chicago.

The History of the Telephone. By Herbert N. Casson. Chicago: A. C. McClurg. 315 pages, illus. Price, $1.50.

Written in a journalistic style, this book will be found interesting reading. It is largely biographical in character and, apparently following Carlyle, gives a dramatic setting to striking episodes in the history of the development of the telephone. The style of the author may be illustrated by the following quotation: "The peculiar electric current that these young pathfinders had to deal with is perhaps the quickest, feeblest and most elusive force in the world. It is as gentle as a touch of a baby sunbeam, and as swift as the lightning flash. Catch the falling tear-drop of a child and there will be sufficient water-power to carry a spoken message from one city to another." The book is frankly written from the standpoint of the Bell interests; Gray and the Independent movement are handled without gloves, and while scores connected with the Bell development are the subject of highly laudatory notice, Kellogg is not mentioned and the work of Edison in telephony is disposed of in less than two lines. Making allowance for its ex parte character, the book will be found highly interesting. From the literary standpoint it is far above the usual book treating in a popular and easily understood manner of a technical development.

WELDING. By Richard N. Hart. New York: McGraw-Hill Book Company. 181 pages, 93 illus. Price, $2.50.

Although dealing with a subject not strictly electrical, yet this volume contains much of interest to the electrical engineer in that it covers the electric processses of welding and the various processes employed by electric railway companies in welding their rails. The major portion of the book relates to the welding of iron and steel, but outlines are given of processes suitable for welding also platinum, gold, silver, aluminum, copper and nickel.

About one-fourth of the book is devoted to electric welding, which is treated in a comprehensive manner, much attention being given to the transformer processes invented by Prof. Elihu Thomson. Among the processes suitable for heavy work considerable space is devoted to the one invented by Dr. Goldschmidt, the so-called "thermit" process, which is frequently used for making continuous welded railroad track. Practically the only disadvantage of this process is its cost, which is too high to permit its use in certain cases.

The numerous references throughout the book show that the information contained therein has been gathered from a large number of reliable sources. The selection has evidently been made with much care and the material has been arranged in very readable order. The book represents the first attempt to present such data on welding in book form, and the book should prove of value to those interested in welding processes.

A HANDBOOK OF GENERAL INSTRUCTION FOR MECHANICS. By Franklin E. Smith. New York: D. Van Nostrand Company. 324 pages, 127 illus. Price, $1.50.

This is a very elementary treatise intended for home study by readers who have had practically no educational advantages. The ground is covered in the following order: Arithmetic; mensuration; simple machines (lever, block and tackle, wheel and axle, etc.), and strength of materials. The subjects are clearly presented and free use of numerical examples is made. The book should prove useful to workmen who desire to get an insight into the principles of mechanics.

New Apparatus and Appliances

STREET SERIES FIXTURES FOR INCANDESCENT LAMPS.

The Benjamin Electric Manufacturing Company, Chicago, Ill., is marketing a line of street series fixtures and sockets, representative illustrations of which are shown herewith. The socket is made of porcelain with integrally formed knobs, has a simple short-circuiting device and film-cut-out mechanism

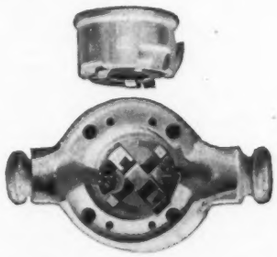


Fig. 1—Street Series Socket.

which may be removed at will with the lower portion, and a supporting casting tapped for ¾-in. pipe. The live portions are thoroughly insulated from the support by a petticoat porce-

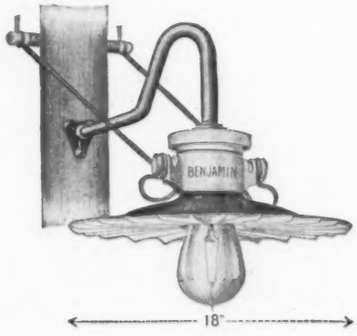


Fig. 2—Street Series Fixture.

lain insulator. The fixtures themselves are furnished with either 18-in. radial wave or flat cone reflectors and suspension straps or 40-in. goosenecks of ¾-in. iron pipe.

MIXED-PRESSURE TURBO-ALTERNATOR SETS.

In the accompanying illustrations are shown two views of a 500-kw mixed-pressure steam turbo-alternator supplied by Dick, Kerr & Company, London, England, to a colliery in Scotland.

The turbine, which is of the impulse type, is designed to give 500 kw with exhaust steam having a pressure of 16 lb. per square inch absolute, or with dry saturated live steam of 90 lb. per square inch, or with a combination of both pressures, and to give the full output when working condensing with a vacuum of 27.5 in., the barometric pressure being 30 in.

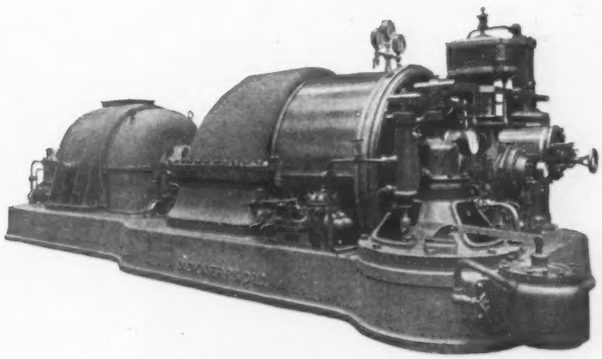


Fig. 1—500-Kw Mixed-Pressure Turbo-Alternator Set.

The turbine is mounted on a combination base, and is complete with two bearings and directly connected to its alternator through a flexible coupling.

The turbine is provided with high-pressure and low-pressure main stop valves, high-pressure steam separator, governor, steam and oil-gage pipes, emergency device for stopping when normal speed is exceeded by 10 per cent, oil receptacles with filter, directly connected oil pump, separate steam oil pumps for flooding the bearings before starting up, speed-adjusting device, etc.

The governor, which is said to be extremely sensitive, is based on a principle which allows steam to enter into the turbine in a continuous and steady flow, whether running on mixed pressure or on live steam, or when changing from one to the other.

The following are the principal features of the turbo-alternator in this combination:

It is designed to give 625 kva (500 kw at 80 per cent power-factor) at 3000 volts and 50 cycles when running at 3000 r.p.m. The temperature rise is said not to exceed 70 deg. Fahr. above an air temperature of 77 deg. Fahr. after an eight hours' run at full load.

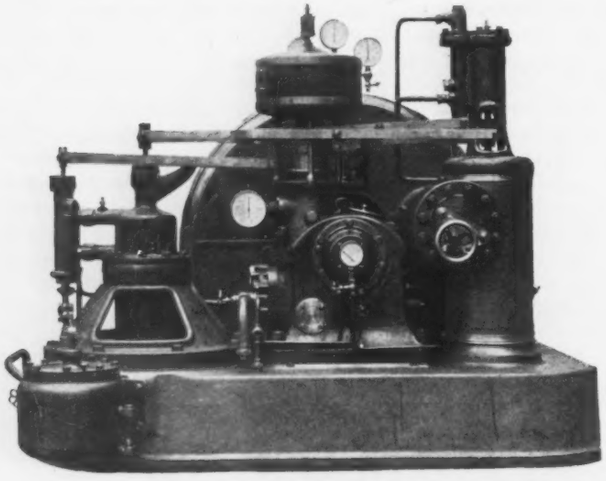
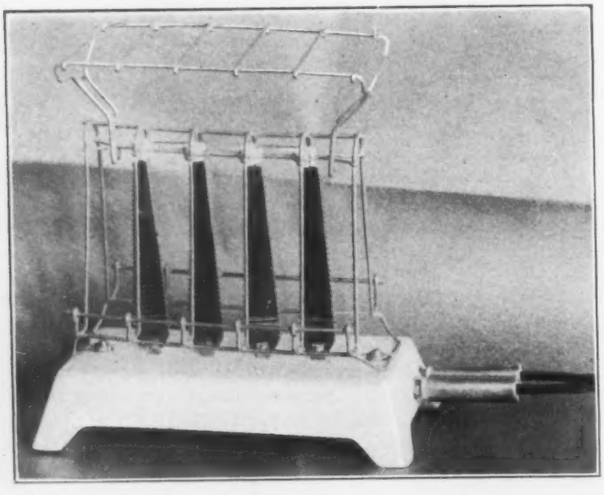


Fig. 2—500-Kw Mixed-Pressure Turbine.

VERTICAL RADIANT TOASTER.

The electric toaster is the most popular of the various electrical cooking devices now available. It is one of those remarkable articles which so completely satisfy all the requirements of real convenience and utility that they rapidly attain the character of modern household necessities wherever electricity is available for domestic use. When the General Electric Company brought out its first vertical type of toaster its advantages were so apparent that it received quick recognition because the new design enabled the making of two slices of toast simultaneously, greatly reducing the time and cost and increasing the convenience of preparing the favorite breakfast dainty. The vertical type of toaster served to establish the value of Calorite as a resistance material for producing intense radiant heat under the influence of an electric current. The 1911 model of the General Electric vertical radiant toaster embodies new features. The inclined rack has been substituted for the perpendicular holder of the earlier design for increasing the convenience of the toaster. The slices of toast are thus rendered more accessible and can be turned around more readily during the process of toasting. The individual contact plugs adopted for the ornamental electric heating and cooking devices are applied to the new toaster. The plugs are incased in polished nickel cylinders, which add to the attractiveness of the toaster and place it in harmony with its companions on the buffet.



Electric Toaster.

ELECTRICITY IN AN ALFALFA MILL.

The extensive use of alfalfa meal for stock feeding in the Western States has caused a very rapid growth of a new industry, namely, the grinding of alfalfa stalks for the production of this highly nutritious product. The mills are usually electrically driven and they form an attractive example of the way in which electricity contributes to the development of a new industry. A typical installation is that of the Kingfalfa Mills, at Nebraska City, Neb. The plant consists of a 300-kva, 440-volt, three-phase, 60-cycle generator of the two-bearing, belt-driven type, driven by a 300-hp non-condensing Corliss engine. The energy developed is used to drive a disintegrator or alfalfa-meal mill and other auxiliary machines, such as blower, dust collector, packer, etc. The alfalfa mill is driven by a 150-hp slip-ring type motor, which is belted direct to the mill

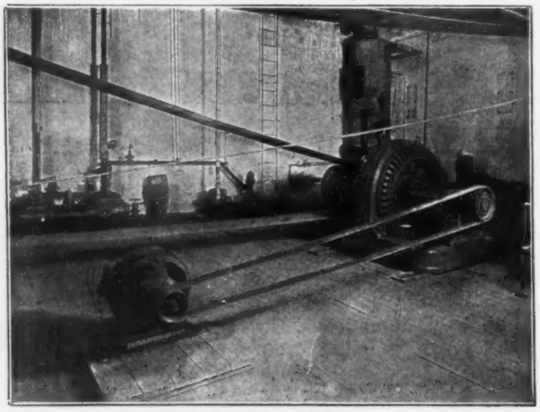


Fig. 1—300-Kw Generator.

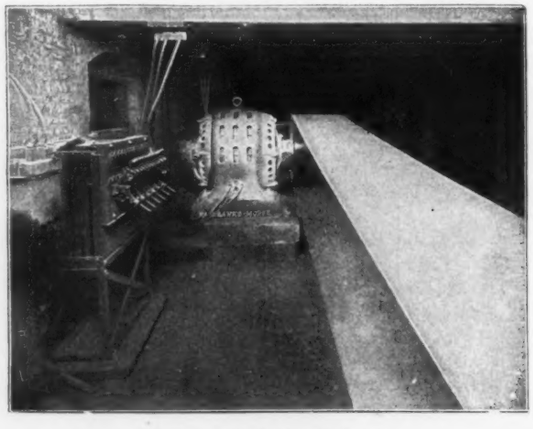


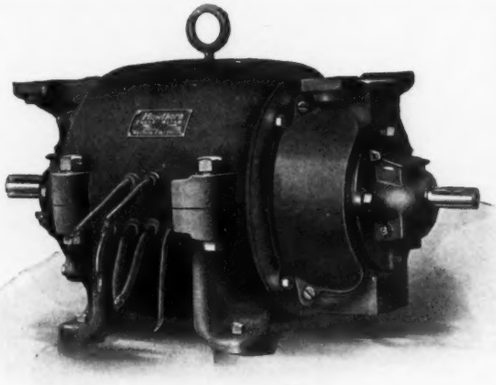
Fig. 2—150-Hp. Motor.

On account of the great weight of the mill and the inertia of the moving parts a high starting torque is required to bring it up to speed, which is a severe test on the motor and generating plant. The main motor drive and the generating unit are shown

in the accompanying illustrations. The plant has a capacity of four tons per hour of the finished product, and in a test of several hours' continuous operation has been worked to the capacity of six tons or seven tons per hour. The entire electrical equipment was manufactured and installed by Fairbanks, Morse & Company through their branch office at Omaha, Neb.

CRANE MOTOR.

A direct-current, reversible and totally inclosed crane motor has been placed on the market by the Western Electric Company. The motor, it is claimed, combines high electrical efficiency with a compact and rigid construction, which insures absolute reliability under the severe conditions common to crane and hoisting service. The motors are of the split-frame type and are built in sizes ranging from 1¾ hp at 1375 r.p.m. to 50 hp at 525 r.p.m. The frame is cylindrical in form and of small diameter, requiring minimum headroom and reducing the moment of inertia to the revolving parts. The frame is cast of soft steel and designed with low center of gravity and ample feet surface for rigidly bolting it in place. The upper half of the frame may be lifted after removing six or eight bolts, depending upon the size of the motor. This leaves the armature and bearings intact. The heads are not split, but can be lifted out after removing the upper half of the frame and the



Crane Motor.

bolts which secure the heads to the lower frame. This leaves the motor practically disassembled. The motor heads, which are held in place by four bolts, are provided with brackets for mounting the back gear shafts and brake pads for the addition of magnetic brakes. The motor heads are adjustable, so that the motor may be mounted in various horizontal positions. The laminated pole-faces, which are cast with the frame, are securely bolted to the poles, so as to reduce iron losses and insure cool operation. The bearings are of the self-oiling, revolving-ring type and their surface is provided with bronze linings. This arrangement insures the efficient lubrication and good wearing qualities necessary for heavy duty. The armature core and commutator are mounted on a quill to facilitate easy removal from the shaft without disturbing the windings. The commutator, coils and brush holders are of the latest improved design and are made for heavy duty.

STORAGE-BATTERY WHARF AND DEPOT TRUCKS.

The Hamburg-American Line has been experimenting for the last year or two with several different styles of Lansden industrial trucks, and recently has adopted as its standard a three-wheeled machine, with a speed of four miles an hour, and capable of carrying 5000 lb.

The driving wheels are provided with the usual type of solid-rubber tire; the steering wheel is spring-mounted, and for dock work is used without the rubber tire. By using the Edison battery these little machines are practically foolproof and can do the work of a steamship company or large warehouse with

Storage-Battery Truck.

a saving of labor which is striking. Inspector Koetter, of the Hamburg-American Line, states that the four trucks now in use have averaged a displacement of five men each, or that one man with a truck will actually handle more freight than could have been handled by six men with the ordinary type of hand truck; and, as there is no appreciable wear on the machine and the cost of operation is very low, they represent a very profitable investment.

The Lansden company has standardized this type of truck in three different styles of varying load capacities, while the carrying platform is designed to suit each customer's needs.

POLE-LINE TRANSFORMERS.

Herewith are shown some views of a line of transformers recently placed upon the market by the Triumph Electric Company, of Cincinnati, Ohio. These are built for single-phase circuits and are of the pole-type construction. The normal frequency is 60 cycles, but the frequency limits range from 50

Fig. 1—Pole-Type Transformer.

cycles to 140 cycles. The standard voltages are 1100-2200 for the primary and 110-220 for the secondary. The transformers are of the improved shell-type construction and possess many important characteristics of especial interest to engineers. Aside from mechanical construction and durability, trans-

former losses are the most important consideration in the selection of any particular design. Too often low core-loss values are obtained at the expense of other important characteristics. It is a well-known fact that a disproportionately low core loss will produce excessive copper loss and poor regulation. Similarly, unnecessary insulation is directly responsible for high reactance, poor regulation and a tendency to overheating, the efficiencies being correspondingly low. While core losses are continuous and should be eliminated as far as possible it is manifestly an error to sacrifice regulation and increase the copper loss in order to obtain unduly low core loss. This is particularly true in regard to regulation. A poorly regulating transformer will cause variation of potential at the

Fig. 2—Transformer with Casing Removed.

lamps, giving rise to flickering and a marked tendency to decrease the life of the lamps. The transformers shown herewith are said to have excellent regulation, low copper losses and decidedly low core-loss values on account of the superior quality and high permeability of the silicon-alloy steel used. This steel the company claims is non-aging even at temperatures well beyond the safe working limit of the transformer. The core-loss claims are based on a sine wave as recommended by the A. I. E. E., and these are, therefore, fixed by a well-defined standard. The transformers are dried under vacuum and impregnated with a special insulating compound absolutely non-soluble in oil and possessing a very high melting point. Severe tests are carried out on each transformer before shipment, and all apparatus is fully guaranteed by the company.

SYSTEM OF INDIRECT ILLUMINATION.

When it was announced about two years ago that reflectors and appliances had been developed which made indirect illumination commercially available the announcement was greeted with more or less skepticism, but judging by the large number of installations since made this skepticism has evidently been more or less dissipated. It was supposed by those marketing the equipment that its chief field would be in residences, and while it has met with much favor there it has been adopted in many new fields. Among those to realize its advantages were the office managers of companies employing large numbers of clerks in their counting-rooms, and this led to the adoption of indirect illumination in numerous smaller counting-rooms and offices. The installation in the new Blackstone Hotel, Chicago, resulted in numerous other hotels and restaurants making installations of the same character. The installation illustrated in these pages some time ago of the auditorium of the South Shore Country Club of Chicago attracted instantaneous and wide attention. The result of this has been similar lighting of the Steel Pier Auditorium at Atlantic City; Osborn Hall, Winnipeg, Canada; New Century Club Auditorium, Philadelphia, and many other places. This system of illumination has proved successful in many fields, and in that of church illumination it seems to have solved the problem that for years has been a serious one. About fifteen churches have

Fig. 1—Shallow-Bowl Lamp Fixture.

Fig. 2—Deep-Bowl Lamp Fixture.

installed or have specified this system. Five new theaters, as well as seven hospitals, have adopted indirect illumination, and it is finding favor in many classes of salesrooms and stores as well. A Chicago company which is installing a chain of 100 stores has adopted it as a feature of its stores. It might be mentioned that there is one class of stores where this system of illumination is not desirable, and that is jewelry stores, where direct rays to bring out the brilliancy are necessary to show off jewels, cut-glass and other articles to the best advantage. Of course, the question of proper fixtures to contain these inverted lighting units has proven a new question to the fixture manufacturers. The National X-Ray Reflector Company, Chicago, Ill., has produced a line of standard fixtures which are sold to the trade either complete or in parts. These fixtures are mostly metal composition, but the company also makes large fixtures of composition. Many artistic and classic designs have been produced to meet the demands of the trade for various kinds of interiors, two of the latest designs being shown herewith.

MACHINE FOR MANUFACTURING TROLLEY WHEELS.

The Garvin Machine Company, New York City, is putting out a labor-saving machine for finishing trolley wheels. The machine, which is shown in Fig. 1, consists of a standard monitor lathe with many special features that adapt it to the rapid

production of this work. The head is equipped with an automatic two-jaw chuck, with the false jaws shaped out to grip the wheel by its hub and drive from the ribs. This chuck is operated by compressed air, the cylinder being mounted on the rear end of spindle, and the air is controlled by a valve on the

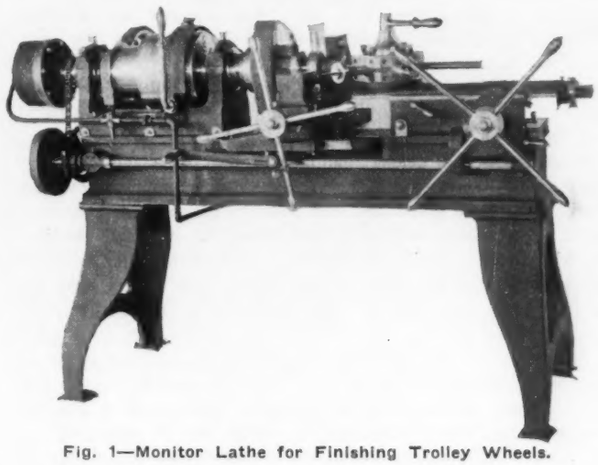


Fig. 1—Monitor Lathe for Finishing Trolley Wheels.

side of the head-stock. A turn of the valve lever causes the jaws to grip the wheel securely, while a turn in the opposite direction causes the jaws to release their grip and makes the device ready to receive the next wheel. Through this feature a big saving of time is realized and the annoyance with the ordinary type of chucks where the casting gets loose and requires the operator to stop the machine and retighten it is overcome. With this automatic chuck the grip increases, it is said, if there is any tendency to slippage, and it also takes up for variations in castings. The finishing of the wheel is done with high-speed tool steel. After gripping the wheel a runner is brought in on the wheel from the turret. This trues the wheel up in a true running position. The second turret operation is drilling the hole; the third turret operation is boring and facing the hole, and the fourth turret operation is reaming the hole. The runner is again brought in on the wheel and the

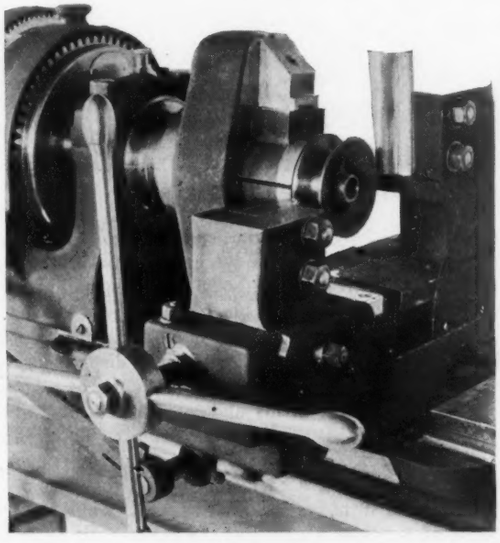


Fig. 2—Double-Acting Cross Slides.

turret slide locked in position by the lever shown on the side of turret base. The runner now holds the wheel running true while the heavy cut in the groove is being taken. This cut is made with a double-acting cross slide, as shown in Fig. 2, both front and rear tools coming in at the same time, the rear tool finishing from a little beyond the center and one side of the groove, the front tool taking a corresponding cut on the opposite side. The cross slide has a side adjustment to it and is operated by a hand lever. With this adjustment the tools are brought into the groove in such a manner that they are not continually cutting scale and losing their edge. The cross-slide tools are made in long strips and can be resharpened without changing their shape. The turret is of the hexagon type and the tools may be bolted to the face, or shank tools may be used. The turret slide is equipped with individual stops, one for each turret hole, and a very fine adjustment can be made. In finishing wheels in this manner they are completed, with the exception of facing the rear of hole. This may be done with a counterbore under a drill press. The wheels come from the machine interchangeable. Wheels 4 in. in diameter are finished in two minutes each and wheels 6 in. in diameter are finished in three minutes. The machine is of a rigid type of construction, weighing 1700 lb. It is simple to operate and can also be arranged for the bushings and hangers. It may also be used on any other class of turret lathe work to the same labor-saving advantage.

LONG-SCALE SWITCHBOARD METERS.

A meter with readings easily legible for use in large installations where this characteristic is essential requires a long and well-illuminated scale. The long scale has been obtained by meter manufacturers in two ways. The simplest and most obvious way is to extend the pointer and the radius of the scale of a short-scale meter until the desired length of scale is obtained. The other method of obtaining a long scale is to increase the arc subtended by the scale, a method involving a completely new design of meter. It was this second method which was adopted by the Westinghouse Electric & Manufacturing Company in placing on the market a line of alternating-current switchboard meters. These are round-pattern meters of the usual size, about 9½ in. in diameter, with scales subtending an arc of 300 deg. and about 14½ in. long. The length of scale usually found only in the large illuminated dial meters is thus obtained in a meter of normal size. There is no metal front on the meter, but instead a round glass cover is used. This makes it possible to iluminate the dial from the front and thus avoid the use of special lamps. The meters operate on the induction principle. The torque depends on the action of a rotating magnetic field on a light, pivoted drum. This principle makes connections to the moving element unnecessary and, by avoiding the use of a copper coil or iron core for the

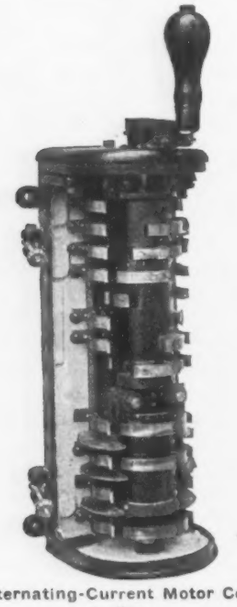
Long-Scale Switchboard Meter.

moving part, reduces the weight on the pivot bearings and consequently the friction. This leads to accuracy and long life. The moving element also has inherent damping qualities and the torque developed is said to be very high. The controlling springs, which balance the torque, are made of a special alloy,

tempered and aged to insure permanence under all conditions. The type of meter shown is made for ammeters, voltmeters, single-phase and polyphase wattmeters, power-factor meters, and direct-reading frequency meters. All of these meters utilize different forms of the induction principle. Single-phase and polyphase static ground detectors are also furnished, harmonizing in size and general appearance with the rest of the line. Synchroscope and the direct-current meters are also made by the Westinghouse company of the same size and appearance, so that a complete harmonious switchboard can be arranged.

CONTROLLERS FOR ALTERNATING-CURRENT MOTORS.

Where speed control is desirable with alternating-current motors the slip-ring type of motor when provided with the proper controlling apparatus is capable of giving excellent service. For printing presses, machine tools and similar machines it is desirable to have very accurate speed adjustment and a convenient means of reversing the direction of rotation of the motor is often desired. The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has for a long time built alternating-current devices, but not until the recently extended general use of alternating currents has it been necessary to standardize a complete line of controllers for this purpose. The reversible-drum controller illustrated is made in standard ratings from 1 hp to 7½ hp and is intended for use with slip-ring types of motors. These controllers can be mounted on the press or machine within convenient reach of the operator, and speed reduction is secured through resistance in the three phases of the secondary circuit, thus maintaining an electric balance at all times, in which condition the motor operates at its best efficiency. In the standard apparatus a speed reduction of 60 per cent is obtained, and for greater reductions slight changes are necessary.



Alternating-Current Motor Controller.

ELECTRICAL DISPLAY SIGN.

A striking electrical display sign combining many original effects is that erected in Federal Park at Louisville, Ky. The steel framework of this sign is 100 ft. long and towers 60 ft. into the air above the surrounding buildings. At each end is a Corinthian pillar 40 ft. in height surmounted by a ball of wrought iron and art glass 4 ft. in diameter. The sign is divided into six rectangular display spaces, each measuring 20 ft. x 30 ft., upon which are built the various advertising displays. Over the sign the word "Louisville" is shown in large letters. The illumination is accomplished by means of 5503 lamps and the color designs are effective. Except for a few red lamps at the base and in the scroll in the capital, the two pillars are a blaze of white light, supporting the art-glass balls, which are lighted from the interior. The word "Louisville" and the strip lighting separating the panels are outlined in white light. One display shows a pianist playing a grand piano, operated by a flasher which causes the player's hand apparently to move up and down the keyboard of the piano and her body to assume different positions. The piano and stool are shown in red and the keyboard in white, while the lady's gown is white, her face and arms illuminated by amber lamps and her hair a very dark red. The lettering is all white. The street car is the most realistic moving effect on the sign. The wheels of the car, outlined in blue lamps, revolve forward and the track, outlined in white, apparently moves backward. Apparently the car is rushing forward at full speed, with its headlight (lighted by a 100-watt tungsten lamp) and the sparking trolley wheel adding to the realness of the effect. Suddenly a gong rings twice and the trolley stops sparking, the wheels cease revolving and the car stops. The appeal to both eye and ear makes this a most realistic electrical effect. The body of the car is green, the top red, the truck and fender blue, and the wheels and track white. The upper right-hand panel is an attractive sign in red and white lamps. Below it the florist's sign displays in natural colors a gorgeous bunch of American Beauty roses operated by a flasher so that the stems and buds appear to grow into full-blown roses, while the ribbon is made to flutter as in a breeze. The sign directly under the street car shows two barefooted children drawing a cart loaded with toy furniture. A flasher makes the little figures seem to walk, while the revolving wheels of the little wagon and the backward motion of the roadway complete the delusion of progress. The cart and furniture are painted in natural colors and lighted with white lamps. The children's hats are red, the dress and trousers blue, and the feet are lighted with amber lamps. The display in the lower left-hand panel is a sign in colored lamps. The conception and erection of the sign is due to Mr. R. H. Frazier, of the Federal Sign System, Chicago and New York, by whom the sign was constructed.

Electric Sign Erected in Federal Park, Louisville, Ky.

Industrial and Commercial News

THE WEEK IN TRADE.

CONDITIONS in commercial trade since the first of the year have shown such little improvement over those that prevailed during the latter part of 1910 that there is a general feeling of disappointment. During the past week trade was distinctly dull in general lines. This is the tenor of reports from both wholesalers and retailers. The only branches in which there is any semblance of activity are those furnishing supplies for farmers. Agricultural implements, fertilizers, fence wire, seeds, etc., are showing a seasonable awakening. The unusually mild weather which has prevailed all over the country has tended to start this class of business earlier than usual, but it has also done much to check activity among the retailers. Wholesalers report that purchases for spring delivery are being made very conservatively. Business men in all parts of the country are determined to run no risk of overstocking until general conditions have improved. In the iron and steel industry there is no apparent change. During the past week the rail order of the New York Central, amounting to 176,750 tons, was allotted and smaller orders amounting to 42,000 tons were placed. This, of course, increased the activities of a number of mills, but it could not be termed new business. There was also some increase in tin plates and the wire mills are busy. One feature of the past week that offers some encouragement is the continued decline in the cost of most food stuffs. This, it is hoped, will stimulate exports and will act as a deterrent on threatened demands for wage increases. Collections are only fair and they continue to be more satisfactory in the West than they are elsewhere. Business failures for the week ended Jan. 26, as reported by *Bradstreet's*, were 345, as compared with 302 the previous week, 295 in the same week of 1910, 311 in 1909, 359 in 1908 and 211 in 1907.

THE COPPER MARKET.

DURING the past week there were some quite heavy sales of copper to domestic consumers. It is hard to estimate exactly the amount of these sales, as selling agencies are prone to exaggerate. There is no doubt, however, that quite a number of large consumers of copper took advantage of the softening of prices to lay up considerable stocks for thirty-day and two-month deliveries. These sales have had the effect of steadying the copper market and holding prices, which had given evidence of a disposition to sag.

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	11.75	12.00	.....
January	11.75	12.00	11.87½
February	11.75	12.00	11.87½
March	11.75	12.00	11.87½
April	11.75	12.00	11.87½

The London market, January 30, was as follows:

	Noon. £ s d	Closing. £ s d
Standard copper, spot	53 17 6	54 2 6
Standard copper, futures	54 10 0	54 17 6

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	12.30c	11.87½c
London, spot	£56 15 0	£53 15 0
London, futures	57 12 6	54 10 0
Best selected	60 5 0	58 10 0

It can hardly be figured out, however, that those sales have in any material way improved the copper situation. The actual consumption of copper, as every man who is familiar with the market knows, is far below the actual production. Under such circumstances the purchases of material by consumers amount only to the storing of copper for future needs and the purchases of material by speculators are only a transfer of the surplus stock from one hand to another. One of the important features of the week was the increase in copper imports. It seems to be apparent that the imports of copper into the United States during the month of January will break all recent records. During the week prices for electrolytic copper were more irregular than usual. While they were quoted as 12.25c @ 12.50c, as compared with 12.50c @ 12.75c the previous week, it is pretty well known that actual selling prices were shaded below these figures. This willingness to make concessions is the explanation of the additional sales. Exports during the latter half of January have been averaging about 1000 tons a day and the total for the month, including Jan. 30, was 27,513 tons. The daily call on the Metal Exchange Jan. 30 quoted standard copper as per the accompanying table.

INDUSTRIAL AND COMMERCIAL NOTES.

Co-operative Buying for Lighting and Traction Properties.—A meeting of general managers representing various electric railway and central-station companies was held in York on Jan. 24, in the office of C. H. Bear, president of the Merchants' Electric Light, Heat & Power Company, in accordance with an arrangement for co-operative buying, which entails meetings about every three months. The meetings are held in rotation in the various cities represented in the organization. Agents of the leading manufacturers of electrical supplies were present, samples of various electrical appliances were displayed and the purchases were usually heavy. In addition, operating conditions were discussed and a variety of business was transacted. The members of the organization present at the meeting were Chairman J. Blair McAfee, Philadelphia; E. C. Matchway, Norfolk & Portsmouth Railway Company, Portsmouth, Va.; W. W. S. Butler, general manager Newport News & Old Point Comfort Railway & Electric Light Company, Hampton, Va.; C. D. Emmons, general manager Fort Wayne & Wabash Traction Company, Fort Wayne, Ind.; J. W. Wolf, superintendent Ohio River Electric Railway & Power Company, Pomeroy, Ohio; C. H. Bear, president Merchants' Electric Light, Heat & Power Company, York, Pa., and I. L. Oppenheimer, general manager Lexington Railway Company, Lexington, Ky

Tri-City Railway & Light Company.—The Tri-City Railway & Light Company, which controls the railway, gas and electric light business of the cities of Davenport, Ia.; Rock Island, Moline and East Moline, Ill., has announced for the coming year construction work which will include a twenty-mile extension to the street railway system. This extension, according to an official of the company, will be built by J. G. White & Company, and with its rights-of-way will cost about $750,000. Contracts which have recently been made with the cities of Muscatine and Davenport for improvements, in consideration of the granting of new franchises, will amount to about $1,250,000, which will bring the total cost of new work for the company for 1911 up to $2,000,000. The funds to carry out this improvement work will be raised through the sale of refunding and improvement bonds which were authorized last year and of which $9,500,000 out of a total of $20,000,000 have been issued.

Chicago Railroad Electrification.—Several steam railroads in Chicago have expressed their willingness to contribute funds for experimental work in the direction of the electrification of Chicago terminals. These companies have been negotiating with the city authorities for some time. Vice-President Parks, of the Illinois Central, said that the railroad officials had been experimenting for some time with other fuels than soft coal, with a view to abolishing the smoke nuisance. All of these experiments, he said, had been unsatisfactory, and now it was intended to look into the matter of electrification. The question of expense has been heretofore considered prohibitive.

Hoosac Tunnel Electrification.—Two of the new electric locomotives which will be used by the Boston & Maine-New Haven Railroad companies in the Hoosac tunnel service have been delivered to the New Haven Railroad. Work on this electrification is being pushed rapidly, and it is estimated that it will cost about $1,000,000. The electric zone will cover a distance of nine miles. Work was begun last October, and it is expected that it will be completed early in the spring.

Arc Light Cost in Columbus.—City officials of Columbus, Ohio, claim that the arc lights furnished by the municipal lighting plant have during the past year cost $43 each, including interest on the bonds, cost of the plant, depreciation and all the other items that enter into cost. The actual price of maintenance, they claim, has been $16.28 for each lamp.

The Diesel Engine.—As recently announced in these columns, the American Diesel Engine Company has been purchased by Mr. Adolphus Busch, of St. Louis, and the engines will hereafter be manufactured by the Busch-Sulzer Bros.-Diesel Engine Company, of St. Louis. The company was incorporated Jan. 26 with a capital stock of $2,100,000, with the following officers and directors: President, Adolphus Busch; first vice-president, August A. Busch; second vice-president and general manager, James R. Harris. Directors: E. D. Meier, president American Society of Mechanical Engineers; Robert Sulzer, of Gebruder Sulzer, Winterthur, Switzerland; Rudolph Diesel, Munich, and Eugene Angert and Daniel L. Kirby, attorneys, St. Louis. The main business of the new corporation will be to build and sell the Diesel oil engine, and it will erect in the near future a complete modern manufacturing plant at an estimated cost of $1,000,000, which will start with 500 employees. The plant will probably be located in St. Louis. Mr. Adolphus Busch, who had introduced the Diesel engine in this country, purchased the assets of the American Diesel Engine Company in May, 1909, and transferred its business from New York to St. Louis under the management of Mr. James R. Harris and under the close direction of Mr. August A. Busch. Since that time Diesel engines of an aggregate of over 11,000 hp have been sold in this country. The new organization has been made in order to enter into the manufacture and sale of the engines on a large scale, and for this purpose it has been supplied with sufficient capital, the best engineering and consulting force obtainable, all the patents necessary to protect the manufacture and will have a plant with the best equipment for the particular kind of work that money can buy. Mr. Max Rotter, the present chief engineer of the Allis-Chalmers Company, has been appointed chief engineer of the new company, and agreements have been made with Robert Sulzer, of Winterthur, and Rudolph Diesel, of Munich, whereby they become partners in the new enterprise. The firm of Messrs. Sulzer Bros., as is well known, has a world-wide reputation as one of the largest builders of high-glass engines in the world.

New York State Electrical Combine.—Application is pending before the Public Service Commission of the Second District of New York for the combination of the Wayne County Gas & Electric Company, Geneva-Seneca Electric Company and the property at Phelps, N. Y., which belongs to J. Q. Howe's Sons. The concerns first named are properties that have been controlled by William T. Morris. The present application asks for the issue of $800,000 of 5 per cent bonds, $250,000 preferred stock, and $200,000 common stock. The Wayne County Gas & Electric Company is a concern that was authorized last August by the Public Service Commission, and represents the merging of the Palmyra Gas & Electric Company; Newark (N. Y.) Gas Light & Fuel Company; New Light, Heat & Power Company, Newark; Lyons Gas Light Company, and the Wayne County Electric Company. Details of this combine were published in the *Electrical World*, Sept. 1, 1910. The Geneva-Seneca company is also a merged concern, and represents the consolidation which was made last year of the Geneva-Edison Company, the Seneca Electric Company and the Economic Power & Construction Company at Geneva. These properties have been operated by the United States Gas & Electric Company. It is now proposed to combine all of the properties into one company, and to add to them the property at Phelps, N. Y. A transmission line will be built from Newark to Geneva, passing through Phelps, thus making a physical connection between the properties. It is probable that the operation of all of these properties will be taken over, when the combine is completed, by W. S. Barstow & Company.

Telephone System on Chesapeake & Ohio.—From Fortress Monroe all the way to Cincinnati, a distance of nearly 1000 miles, the Chesapeake & Ohio Railroad will soon be using the telephone method of controlling train movements. Since last March the telegraph has been supplanted for train dispatching over four of the most important divisions of this road. Two new divisions were recently equipped with telephones and have rendered service since Dec. 24. The telephone system is now complete from Richmond to Cincinnati by the James River route. The telephone system now in use comprises 545 miles with 154 way stations. When present plans are completed nine divisions will be equipped, with 992 miles and 248 telephone way stations. The railway is rushing the construction gang to get the line wires up, so that the telephones may be put into operation at the earliest possible date. The new equipment will be installed on the main line between Clifton Forge and Charlottesville, between Charlottesville and Richmond and between Richmond and Fortress Monroe. The telephone and installing material is being furnished by the Western Electric Company.

New York State Telephone Mergers.—The New York Telephone Company has applied to the New York Public Service Commission of the Second District for permission to make several transfers in telephone ownerships. It is proposed to sell for $35,000 the property of the New York Telephone Company in Allegany County to the new Allegany Telephone Company, and in connection with this certain franchises held in Wellville and Andover. It is also proposed to sell the Automatic Telephone Company for $150,000. The merging of the Trumansburg Telephone Company and the Jefferson County Telephone Company into the New York Telephone Company also is planned, the New York company owning the stock of those companies already. The plan also contemplates transferring the property and franchises formerly belonging to the Central New York Telephone & Telegraph Company in Oneonta, Unadilla, Richfield Springs, Laurens, Cooperstown and Walton, now owned by the New York Telephone Company, to the Otsego & Delaware Telephone Company for $98,000.

New Generating Plant at El Centro, Cal.—The Holton Power Company, of Redlands, Cal., is about to begin the construction of a steam plant for the generation of electricity at El Centro, Cal., where one of its generating stations is now located. The company operates a hydroelectric development and the old steam auxiliary plant has been found inadequate. To provide for future possibilities W. F. Holt, president of the company, has decided to install a much larger and more modern steam-generating plant. The new equipment will be rated at 1200 hp and is expected to be ready for operation before the close of this year. Mr. Holt announces that he will expend $250,000 this year in improving the electrical system of the Holton Power Company and that the larger part of this sum will be expended on the new steam generating plant. Contracts for the building and much of the machinery have been awarded.

Los Angeles Consolidation Completed.—Paul Shoup, vice-president of the Southern Pacific Railroad, in charge of electric lines, announces the consolidation of the management of the Pacific Electric Railway and the Los Angeles Pacific systems with these officers: J. McMillan, general manager in charge of operation; George E. Pillsbury, chief engineer, in charge of construction; E. C. Johnson, assistant chief engineer; D. W. Pontus, traffic manager; Fred S. Small, mechanical engineer, and S. H. Anderson, electrical engineer. Robert P. Sherman, general manager of the Los Angeles Pacific, retires. The Los Angeles & Redondo Railway, which also belongs to the Southern Pacific, will probably soon be placed in charge of the same officials. The deal for the physical consolidation of the Southern Pacific's electric properties was detailed in our issue of Nov. 24, 1910.

New York Telephone Building.—Plans are being drawn for the New York Telephone Company for the erection of a twenty-five story building on the corner of Walker and Church Streets. The plot on which the building will stand is 22,000 sq. ft. The telephone and Western Union Telegraph companies will occupy the entire structure except the ground floor. The switchboard which the company plans will, it is said, be the largest in the world and will seat 200 operators and take care of the service of 20,000 subscribers. R. M. Ferris, engineer of the company, will supervise the installation of the switchboard. The cost of the property and building will be about $2,500,000.

American Conduit Company.—The American Conduit Company reports that it has had the best year—1910—in its history. The company has recently shipped to London for various services sold in England 136,000 ft. of conduit. During the past three months the company has also sold to the Norfolk & Western Railroad Company very nearly a million feet of conduits, which are to be used for signaling purposes. W. W. Grant, the New York manager of the American Conduit Company, sailed for England, Jan. 18, on a business trip, and will be absent until the early part of March.

Union Gas & Electric Company.—The gross earnings of the Union Gas & Electric Company, of Cincinnati, for the last quarter of 1910, according to the report filed with the city auditor, were $530,246. This compares with $500,727 in the same period of 1909.

Financial.

THE WEEK IN WALL STREET.

THE feature of the Wall Street market last week was the sale by the City of New York of $60,000,000 of 4¼ per cent, 50-year city bonds. The average return which the city will get from this sale is about 100.90. While this may not be considered as an extremely high price, the fact that the bonds were subscribed more than five times is significant of the fact that there is plenty of money yet to be invested in good securities. The bid of the J. P. Morgan & Company syndicate, which was the largest single bid received, came within a very

NEW YORK.

	Jan. 23.	Jan. 30.	Shares Sold.		Jan. 23.	Jan. 30.	Shares Sold.
All. Ch.....	8*	8½	600	Int. Met., pf.	51¼	54	21,300
All. Ch., pfd.	29	33⅛	1,100	Mackay Cos.	92½*	92½*	———
Amal. Cop...	63⅜	63⅛	62,125	Mackay C.,pf.	75¼	75¾*	500
Am. D. T...	20½*	20½*	———	Man. Elev...	138	138	900
Am. Loco...	40⅛*	40¾	3,000	Met. St. Ry.	15*	15*	———
Am. Loco.,pf.	110⅜	110¼	200	N.Y.&N.J.Tel.	139½*	139½*	———
Am. Tel. & C.	83½*	83½*	———	Steel, com..	77⅞	79⅜	589,300
Am. T. & T..	143½	144¼	11,600	Steel, pfd....	119	120	5,280
B. R. T.....	76⅝	77⅝	13,235	W. U. T....	74½	75	3,200
Gen. Elec....	151½	153½	3,300	West'h, com.	67	66⅞*	200
Int. Met....	18¾	19⅜	8,527	West'h, pfd..	119*	117*	100

PHILADELPHIA.

	Jan. 23.	Jan. 30.		Jan. 23.	Jan. 30.
Am Rys.....	45	45¼	Phila. Elec.....	16⅛	16
Elec. Co. of A.....	12⅛	12¼	Phila. R. T.....	20¼	20⅛
Elec. St. B'ty.....	53	53⅞	Phila. Trac.....	86½	86½
E. S. B'ty., pfd....	30*	30*	Union Trac.....	47¾	47½

CHICAGO.

	Jan. 23.	Jan. 30.		Jan. 23.	Jan. 30.
Chi. City Ry.....	185*	185*	Chi. Tel. Co.....	118	119*
Chi. Rs., Ser. 1.....	93	93	Met. El. Co.....	21	21*
Chi. Rs., Ser. 2.....	25	25	Met. El., pfd.....	67½*	67*
Com. Edison.....	113	114½	Nat'l Car.....	117*	117*
Chi. Subways.....	4⅛	4	Nat'l Car., pfd.....	118*	118*

BOSTON.

	Jan. 23.	Jan. 30.		Jan. 23.	Jan. 30.
Am. T. & T.....	143⅝	144¼	Mex. Tel.....	6*	4¾
Cum. Tel.....	146½*	146¼*	Mex. Tel., pfd.....	6*	6
Edison E., Ill.....	288	290½	N. E. Tel.....	138⅛	138½
Gen. Elec.....	151	152⅞	W. T. & T.....	18½	18
Mass. E. Ry.....	18	18*	W. T. & T., pfd....	89	92
Mass. E. Ry., pfd...	85½	85			

*Last price quoted.
Shares sold for five days, Jan. 23 to Jan. 28.

small fraction of being successful for the entire amount. In fact, the Morgan bid was about 100.85 for the entire issue. The failure of this bid to succeed saved Wall Street speculators from a considerable loss. There had been much short selling of these bonds before their issue, and the average price of short selling was a trifle less than 101. The result of the bidding shows that the speculators were very close to the true condition of the market. The stock market during the week continued to be strong but rather inactive. Prices have been pushed up several points, but trading has been limited and the majority of deals have been made by speculators. In truth, the condition of the market last week indicated that the entire stock market was well liquidated. There seem to be very few long holdings and there seems to be absolutely no courage in the bear clique. Neither the condition of commercial trade nor the promise of outside buying is such that there should be any definite upward movement, nor is there any such depression in business nor any such general pessimism that there should be a distinct downward movement. Money conditions are all in favor of a buying movement. The bond market is good and there is an evident desire on the part of outsiders to buy gild-edge bonds that will yield a revenue in the neighborhood of 5 per cent. Quotations for money Jan. 30 were: Call, 1½ @ 2 per cent; 90 days, 3¼ @ 3½ per cent. The quotations in the table are those of the close Jan. 30.

FINANCIAL NOTES.

Railway Consolidation Rumors in Chicago.—It is reported that negotiations are under way between the Chicago & Milwaukee Electric Railroad Company and the Northwestern Elevated Railroad Company, of Chicago, by which the former will obtain terminal facilities in Chicago, connecting with the Northwestern Elevated's tracks at Evanston, Ill. It is also reported that there is to be an actual consolidation between the two companies, although this is denied in some quarters, where it is stated that the arrangement is simply a traffic agreement. The Chicago & Milwaukee road is in the hands of receivers, but A. C. Frost, who is the former president of the company, is reported to have said that the road will pass under new management. It is also declared that Mason B. Starring, president of the Northwestern Elevated, will be the president of the new company in process of formation for the purpose of combining the franchises of the two existing companies. The report that all the surface and elevated railways of Chicago are to be combined has been revived. The companies owning these railways have outstanding stock and bonds amounting to $271,736,720. It is said that J. P. Morgan & Co. are interested in the project, which has been discussed at intervals for several years. It would seem that this possible consolidation would have an effect on the reported amalgamation of the Chicago & Milwaukee Electric and the Northwestern Elevated, as mentioned above.

American Electric Telephone Company a Bankrupt.—On Jan. 23 the American Electric Telephone Company of Chicago, by P. C. Burns as president, filed a petition in voluntary bankruptcy before Judge Carpenter, of the United States District Court for the Northern District of Illinois. The schedule of assets and liabilities accompanying the petition shows total claims against the company amounting to $597,014. The total assets are given at $396,823. The value of stock in trade, machinery, tools, etc., is placed at $220,000, and the debts due the company on open account amount to $48,470. The petition was referred to Referee S. C. Eastman, who will examine the officers of the corporation. The company has a large factory at South State and Sixty-fourth Streets, and a few years ago was a conspicuous factor in the Independent telephone field. It is said that the action of the company in asking to be adjudged a bankrupt is due to a judgment obtained against it on its debenture bonds. The bankruptcy proceedings may perhaps result in the reorganization of the company. One of the largest creditors is P. C. Burns, the president of the company.

Chicago Railways Bond Sale.—The National City Bank and Harris, Forbes & Company, of New York, are offering to the public $15,000,000 of first-mortgage 5 per cent bonds of the Chicago Railways Company. These are the bonds which were recently issued for the purpose of paying for the 128 miles of trackage taken over from the Consolidated Traction Company and for paying for the rehabilitation of all of the Chicago Railways lines. With this issue the total bonded indebtedness of the Chicago Railways Company will be $40,955,000. The company will have 445 miles of single track, and the advertisement of the bankers selling the bonds is that the net earnings, after all expenses and reasonable depreciation charges have been paid, will be more than double the interest on the bonds. These bankers are offering this issue at 98 and interest, which brings to the investor a trifle more than 5 per cent.

Kings County Electric Light & Power Company.—The financial report of the Kings County Electric Light & Power Company for the year 1910 showed that it earned a balance available for dividends equal to 9.91 per cent on the $10,000,000 outstanding capital stock, as compared with 8.41 per cent in the previous year. The company continued throughout the year its liberal policy of charging off large amounts from current revenue for depreciation. The net surplus for 1910, after payment of fixed charges, was $991,013. The full pamphlet report of the company has not yet been issued, but it will undoubtedly show that during the year the company enjoyed the largest degree of improvement and development shown in any year of its history.

Consolidated Gas, Electric Light & Power Company.—J. E. Aldred, president of the Consolidated Gas, Electric Light & Power Company, of Baltimore, makes the announcement that arrangements have been completed for listing that company's securities on the London Stock Exchange. A large amount of English and Canadian capital is invested in the Baltimore enterprise. The earnings of the company in 1910 showed a very satisfactory increase over the previous year and the campaign for new business has been actively pushed since Mr. Aldred became president.

Kentucky Securities Corporation.—A charter has been granted under the laws of Virginia to the Kentucky Securities Corporation, with an authorized capital of $5,000,000 equally divided between preferred and common stock. While no official announcement has been made, it is understood that the company is to be a holding corporation for the traction and lighting systems of Lexington and the interurban lines in Central Kentucky. These, it is said, will be consolidated under the title of the Kentucky Traction Company.

American Telephone & Telegraph Company.—The report of the American Telephone and Telegraph Company for 1910 shows that the expenditures on property, including extensions, new equipment, etc., of all the Bell companies in the United States, were approximately $60,000,000. This is more than double the $28,700,000 spent in 1909, and is the largest plant addition in any year of the company's history, with the single exception of 1908, when $80,000,000 was credited to improvements. The remarkable feature of this enormous expenditure for improvements and extensions is that it was achieved with very little new financing. On the part of the American Telephone & Telegraph Company there was absolutely none. Some of the subsidiary companies, however, sold large issues of bonds. The telephone officials estimate that it will be at least fifteen years before the annual expansion of the telephone industry catches up with the growth of population and with the growth of the use of telephones. With the standardization of equipment and the widespread concentration of telephone service the development of the business has been enormous. The growth of the Independent telephone companies has not been threatening, owing to the fact that the associated Bell companies have been able to offer customers many advantages. The only considerable Independent concern is the organization formed in Ohio about a year ago by J. P. Morgan & Company, but as Mr. Morgan is generally known to be a large owner of American Telephone & Telegraph Company securities, it is not thought that this organization will cause any serious trouble.

American Electric Telephone Company.—P. C. Burns has announced that on account of past due interest on debentures which were placed by the American Electric Telephone Company about eleven years ago, when the telephone manufacturing business was very prosperous, receivership proceedings were threatened by Eastern parties, and in order to conserve the interests of all a petition has been filed by the company for a receiver. The receiver will operate the property as before with a view of a reorganization. Mr. Burns states that the sale of many large operating plants to the Bell company so reduced the demand for central-energy apparatus as practically to destroy the once great value in the American company's patents, tools and organization used in central-energy work. Moreover, the competition in the telephone manufacturing business is very severe, caused largely by public service corporations not only selling, directly or indirectly, all kinds of supplies and apparatus to their own systems, but also selling to other systems as well. The American Electric Telephone Company, he states, has paid in full all its merchandise creditors, does not owe a dollar to any bank, and aside from a few small creditors all moneys due are owing to the bondholders and himself. The receiver will continue supplying a full line of telephones, switchboards and general telephone supplies.

Nebraska Coal & Power Company.—It has been announced in the West that an arrangement has been made by the promoters of the recently organized Nebraska Coal & Power Company with an English syndicate for the sale of a $10,000,000 issue of bonds. It is proposed to build an electric line from Caspar, Wyo., to Rawlins, Baggs and Dixon, in the same State, and possibly to reach some towns in Northern Colorado. The road will connect a rich mineral and agricultural territory with railroad trunk lines. It is proposed to build a large hydroelectric plant on the North Platte River, and probably later on another plant on the Little Snake River. The company will also sell power to mines and farmers. Captain H. A. R. Gray has been made general manager of the new enterprise.

Associated Gas & Electric Company.—The annual meeting of the Associated Gas & Electric Company was held Jan. 26. The old directors were re-elected and subsequently the old officers were again chosen. These include W. S. Barstow, president; O. Clement Swenson, treasurer, and Joseph B. Taylor, secretary. The financial report of the company showed that the net earnings for 1910 were considerably more than sufficient to pay the 6 per cent dividend on the preferred stock. In fact, the surplus after payment of this dividend would have been sufficient to pay a similar dividend on the common stock. No such dividend, however, was declared, and probably none will be declared during 1911. At the present time it is the policy of the company to leave the balances in the possession of the underlying companies.

Seattle Electric Company.—The surplus earnings of the Seattle Electric Company for the year 1910 were sufficient to meet the usual 6 per cent dividend on the preferred stock and leave a balance available for the common stock equal to 11.95 per cent. This compares with about 14.25 per cent earned on the common in 1909. The gross earnings of the company for the year were $5,588,188, and the surplus after paying all charges was $1,068,070. The company at present operates substantially all of the street railways and does the greater part of the electric light and power business in the City of Seattle. Stone & Webster, of Boston, operate the property.

Public Service Corporation of New Jersey.—A report has been made to the New York Stock Exchange by the Public Service Corporation of New Jersey showing its income account for the year 1910. The total gross income from all sources amounted to $29,205,194, as compared with $26,560,451 the previous year. After expenses and taxes were paid there was a net income of $14,593,896, and after paying interest on bonds, notes, etc., a net surplus was left for dividends of $2,200,297. The balance sheet of the company, which was filed at the same time, shows total assets of $72,870,332. The capital stock is $25,000,000 and the bonded indebtedness is almost $45,000,000.

Richmond (Ky.) Electric & Power Company.—The directors of the Richmond Electric & Power Company have authorized and will immediately issue $50,000 of 6 per cent first mortgage convertible sinking-fund bonds. The United States Trust Company, of Louisville, Ky., will act as trustee of this issue. Of these bonds $30,000 will be used to retire the present mortgage, and the remaining $20,000 will be used for extensions to the plant. These bonds are convertible at any time into 7 per cent preferred stock of the company.

Salem (N. J.) Electric Company.—W. S. Barstow & Company, of New York, have purchased the Salem Electric Company, at Salem, N. J. This company had an authorized capital of $50,000, upon which a 6 per cent dividend has been earned. Barstow & Company will continue to operate the plant, and during the coming year a considerable sum will be spent for extensions and improvements.

Chicago & Milwaukee Electric Bonds.—A new issue of $3,500,000 in bonds by the Chicago & Milwaukee Electric Company will shortly be made, the proceeds of which will be used to pay off $1,080,000 of bonds due in 1919 and the Wisconsin receivership certificates.

DIVIDENDS.

Consolidated Gas Company, New York, quarterly, 1½ per cent, payable March 15.

Duluth-Superior Traction Company, quarterly, preferred 1 per cent, common 1¼ per cent, both payable April 1.

Philadelphia Company of Pittsburg, semi-annual, 2½ per cent, payable March 1.

Susquehanna Railway, Light & Power Company, semi-annual, preferred 2½ per cent, payable March 1.

Twin City Rapid Transit Company, quarterly, preferred 1¾ per cent, common 1½ per cent, both payable April 1.

REPORTS OF EARNINGS.

AMERICAN LIGHT & TRACTION COMPANY.

Period.			Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
1m.,	Dec.	'10	$427,098	$9,958	$417,131	.....	.....
1 "	"	'09	391,822	9,562	382,260	.....	.....
Yr.,	Dec.	'10	3,832,552	119,688	3,712,864	.....	.....
Yr.,	"	'09	3,345,441	106,261	3,239,180	.....	.....

COLUMBUS (OHIO) RAILWAY & LIGHT COMPANY.

Year,		1910	$2,378,720	$1,618,223	$760,497	$1,011,975	*$234,170
Year.		1909	2,577,202	1,290,133	1,287,069	971,707	333,227

MASSACHUSETTS ELECTRIC COMPANIES.

Yr.,	Dec.	'10	$2,015,771	$1,461,603	$554,167	$456,829	$97,337
Yr.,	"	'09	1,921,073	1,328,901	592,172	444,654	147,518

MEXICAN LIGHT & POWER COMPANY (Mexican Currency).

1m.,	Dec.	'10	$736,260	$200,772	$535,488	.....	.....
1 "	"	'09	563,040	119,079	443,961	.....	.....
Year,		1910	7,234,308	2,070,866	5,163,442	.....	.....
Year,		1909	6,039,710	2,991,827	3,047,883	.....	.....

NASHVILLE RAILWAY & LIGHT COMPANY.

Yr.,	Dec.	'10	$1,832,465	$1,030,016	$802,438	$402,426	$400,012
Yr.,	"	'09	1,724,389	1,013,883	710,497	394,353	316,144

NIAGARA FALLS POWER COMPANY.

Yr.,	Dec.	'10	$2,203,134	$438,733	$1,764,400	$1,251,845	$665,061
Yr.,	"	'09	1,952,348	431,297	1,521,051	1,200,635	454,494

NORFOLK & PORTSMOUTH TRACTION COMPANY.

1m.,	Dec.	'10	$179,111	$94,878	$84,233	.....	.....
1 "	"	'09	163,444	95,394	68,050	.....	.....
6 "	"	'10	1,079,823	598,059	481,764	.....	.....
6 "	"	'09	988,411	554,735	433,676	.....	.....

VIRGINIA RAILWAY & POWER COMPANY.

1m.,	Dec.	'10	$197,794	$95,122	$102,672	.....	.....
1 "	"	'09	175,246	88,906	86,340	.....	.....
9 "	"	'10	1,131,892	560,588	571,304	.....	.....
9 "	"	'09	1,020,520	535,697	484,823	.....	.....

*Deficit.

General News

Construction News.

MOBILE, ALA.—Preparations are being made by the Mobile Light & Railroad Company for building an extension to its Spring Hill Avenue line, several miles in length, to connect with the government street-car line in Mobile.

SPEIGNER, ALA.—Bids will be received by J. Craig Smith, president State Convict Bureau, Montgomery, Ala., for furnishing the electric supplies and accessories for the construction of main underground feeders from the hydroelectric power house at Speigner, Ala., to the State Cotton Mill, including wire, conduits, accessories, etc., to connect feeder panels at cotton mill with ten three-phase motors, materials for manholes and covers. Bids will be received for materials and construction work or for materials alone. Specifications can be obtained on application to Edgar B. Key, chief engineer, State Convict Bureau, Tuscaloosa, Ala.

BENSON, ARIZ.—The Board of County Supervisors has granted a franchise to R. G. Arthur to install an electric light plant in Benson. A company will be organized in the near future by M. J. Cunningham, S. F. Meguire, W. M. Adamson and Perter Jensen to take over the franchise.

BENTON, ARK.—The Benton Electric Light, Power & Ice Company has recently purchased a six-ton ice-making plant from the York Manufacturing Company, of York, Pa.

LITTLE ROCK, ARK.—Plans are being prepared by the Arkansas Interurban Railway Company for the construction of an electric railway from Little Rock to Hot Springs and a belt line in Little Rock, seventy miles in length. H. H. Edwards, 764 Oakwood Boulevard, Chicago, Ill., is interested in the proposed railway.

RUSSELLVILLE, ARK.—The Russellville Water & Light Company is planning to build an auxiliary steam power plant in Russellville to be completed by Aug. 1, 1911. The plant will be able to carry the entire load. The company expects to erect a transmission line to Atkins during the next six months. F. E. Leonard is manager.

WYNNE, ARK.—Preparations are being made to rebuild the municipal electric light plant at once, changing the system from direct to alternating current. Bonds to the amount of $50,000 will be issued soon to provide funds for same. W. H. Allnut is superintendent.

CALEXICO, CAL.—The Calexico Farmers & Merchants' Club has appointed a committee, consisting of J. B. Hoffman, J. F. Steintorf and H. J. Rick, to secure estimates of the cost of installing and operating an electric light plant in connection with the municipal water-works system.

COLTON, CAL.—The City Clerk has been authorized to advertise for an air compressor capable of furnishing 600 cu. ft. per minute, three 6-in. air lifts, two electric motors and two transformers.

DEL MAR, CAL.—The South Coast Land Company is contemplating the installation of another generating unit in its plant and extending its transmission lines. The installation of an ice plant in connection with the light plant is also under consideration. W. G. Abdill is manager and J. S. David is engineer of power station.

EL CENTRO, CAL.—Preparations are being made by the Holton Power Company, of Redlands, Cal., for the construction of a steam generating plant at El Centro, Cal., which will have an output of 1200 hp. The company will make improvements to its system this year, which will involve an expenditure of about $250,000, a large portion of which will be spent on the generating plant in El Centro. Contracts have been awarded for the building and a large portion of the machinery. W. F. Holt, of Redlands, Cal., is president of the company.

EUREKA, CAL.—The Vance Reedwood Lumber Company is reported to have awarded a contract to the Allis-Chalmers Company, of Milwaukee, Wis., for the installation of a large steam turbine and complete electrical equipment for an electric power plant at the Samoa Mills.

FRESNO, CAL.—The San Joaquin Light & Power Company has offered to furnish a site in Fresno, containing more than eleven acres, to the State of California for the State Normal School free of charge.

GILROY, CAL.—The Coast Counties Power Company has submitted a proposition to the City Council to lease the municipal electric-light plant for a term of five years, to make whatever extensions may be necessary, including Morgan Hill and adjacent districts, for which the city is to pay the cost after each proposed item has been approved by the Council. In return for the lease the company proposes to pay the city 10 per cent of the gross receipts during the period of the lease; it will guarantee that there will be no increase of rates during the term of the lease and also agrees to reduce the rates if sufficient patronage to justify such reduction is given the company. The municipal plant has not been operated at a profit since its installation.

LONG BEACH, CAL.—The contract for the installation of electric fixtures for lamps and motors in the new Polytechnic High School has been awarded to the Towne Electrical Company. A. B. Sturges is architect.

LOS ANGELES, CAL.—The Southwestern Sugar Company, of Los Angeles, Cal., recently incorporated, is reported to have purchased property near Perris, on the Santa Fé Railroad, where it proposes to erect a 500-ton sugar factory, at a cost of $500,000, plans for which are now being prepared. The plant will be equipped for electric motor drive throughout. D. Howarth, M. B. Jones and others are interested in the company.

MOORE'S FLAT, CAL.—Arrangements are being made by the Andy Fitz Mining & Milling Company for the erection of a mill at the Fruitvale mine. A generator will be installed to provide electricity for lighting. O. B. McKay is engineer.

OAKLAND, CAL.—The property and holdings of the East Shore & Suburban Railway Company, which operates an electric railway connecting Richmond and Oakland, have been acquired by the United Properties Company. It is said that the change in ownership of the East Shore & Suburban Railway means the extension of the Key Route into Richmond at an early date. William S. Tevis is vice-president of the railway company.

ORANGE, CAL.—The Merchants and Manufacturers' Association has appointed a committee to take charge of placing the ornamental lamp standards for the new lighting system. The standards are of cast iron and will cost $80 each. J. W. Morrison is a member of the committee.

PLACERVILLE, CAL.—It is reported that preparations are being made for the complete survey and placing of the power site, ditch rights and other interests at Chili Bar, owned by John Pearson, of Placerville, and now under bond to the Sacramento & Sierra Railway Company. It is understood that the company proposes to erect a hydroelectric plant to furnish power to operate its railway. J. A. Graham, of Berkeley, Cal., has charge of the engineering work.

REDDING, CAL.—George L. Bancroft, of Denver, Col., has located a water-right three miles north of Redding, claiming 25,000 in. of water in the Sacramento River.

REDLANDS, CAL.—Plans have been prepared by the City Engineer for the installation of an ornamental street-lighting system for the business district of the city, bids for which will soon be asked. The cost of the system is estimated at about $14,000.

REDWOOD CITY, CAL.—The Sierra & San Francisco Power Company has filed amendments to its articles of incorporation. The principal place of business has been changed to Millbrae, Cal. The company is capitalized at $20,000,000. J. S. Thornton, Winfield Dorn, H. F. Jackson, George H. Whipple and W. Gregory are among the directors.

SACRAMENTO, CAL.—The contract for lighting the city for the year 1911 has been awarded to the Sacramento Electric, Gas & Railway Company. The new contract provides for the installation of new lamps by July 1 if the new style lamp suggested by the company is acceptable to the City Council.

SAN FRANCISCO, CAL.—The Tevis local system, which began furnishing electricity from a plant in the basement of the Whitney Building a year ago, under the name of the Consumers' Light & Power Company, has completed three additional plants under the United Light & Power Company as the holding company. One of these, the Equitable Light & Power Company, which has a plant in the Phelan Building, having an output of 2000 kw, began operations Jan. 16. The company also supplies steam heat through underground mains to the surrounding district. The plant of the Southside Light & Power Company, the third system, was started on the same date. The power station of the Southside company is located on Minna Street, near New Montgomery Street, which is equipped with a 2000-kw turbo-generator set, and will soon be ready to start operation. Westinghouse turbo-generators and Sterling water-tube boilers are used throughout the entire system. The Oakland branch, located at First and Alice Streets, under the name of the Central Oakland Light & Power Company, started commercial operation Jan. 14. The plant has an output of from 2000 to 3000 kw in two units. Electricity is distributed through several miles of underground conduits and contracts have been secured for considerable business.

DENVER, COL.—Acting on the suggestion of the Rocky Mountain Fire Underwriters' Association, following its recent inspection of the fire-fighting facilities in Denver, the Denver Union Water Company has arranged to make a complete electrolytic survey of its mains and to take up any necessary bonding with the Denver City Tramway Company. No damages are known to have resulted from electrolysis for four years.

FORT MORGAN, COL.—The city will purchase a 250-hp boiler for the municipal electric light and water plant in the spring. A 75-hp, 2300-volt General Electric motor for the pumping plant was recently purchased to be delivered March 1. George L. Cox is superintendent.

GRAND JUNCTION, COL.—Orders have recently been placed by the Grand Junction Electric & Ice Company, of Grand Junction, Col., for one forty-five-ton and one ten-ton high pressure side; a twenty-five-ton freezing and a sixty-ton distilling system.

TRINIDAD, COL.—The City Council is considering conduit, electrical and gasoline lighting ordinances, both of which are stipulated as part of

the fire prevention improvements necessary before a lower classification and a rate reduction will be made by the Rocky Mountain Fire Underwriters' Association.

BRIDGEPORT, CONN.—Announcement has been made by the United Illuminating Company of a reduction in the price of electricity from 11 cents to 10 cents per kw-hour, the new rate to take effect from Feb. 1.

DANIELSON, CONN.—The Cochrane Power Company has given notice of its intention to apply to the superior court for authority to change its name to the Pomfret Power Company. The company is building a dam across the Quinebaug River near Cotton's Bridge, and has commenced work on the development of a power plant there.

STRATFORD, CONN.—At a recent town meeting the citizens voted to instruct the Selectmen to contract for 100 more lamps, in addition to the fifty authorized. An appropriation of $2,500 was made to pay for same.

MILTON, DEL.—The Milton Light, Power & Water Company is planning to erect an electric light and power plant in Milton to cost about $20,000. O. S. Betts, B. F. Walls and W. W. White, all of Milford, Del., are interested in the project.

WASHINGTON, D. C.—Plans have been presented to Congress by Major Judson for improving the street-lighting system on several miles of the prominent streets of the city which will involve an expenditure of about $12,000. It is proposed to erect the same style of lamp standards as are in use on Sixteenth Street.

JACKSONVILLE, FLA.—Preparations are being made by the Jacksonville Electric Company for the construction of power plant and pier on the Russell and Robinson estates, recently acquired. The cost of the power house is estimated at about $450,000. It is expected that work on construction of the plant will begin in March. The company is controlled by the Stone & Webster Engineering Corporation, of Boston, Mass. It is understood that Arthur L. Negus, superintendent of construction of the Stone & Webster Corporation, will have charge of the work.

PERRY, FLA.—The Perry Electric Company is contemplating installing a new 15-ton refrigerating plant this spring and disposing of its present 6-ton machine. J. H. Scales is secretary and treasurer.

CANTON, GA.—Plans are being considered to enlarge the municipal electric light plant during the present year. J. W. Alford is superintendent.

CARROLLTON, GA.—The Railroad Commission has granted the Gainsboro Telephone Company permission to increase its capital stock to $250,000. The company has recently been reorganized and the proceeds of the additional stock will be used for improvements to its plant.

DALTON, GA.—The City Council has authorized Mayor Trammel to secure options for a site for the removal of the water works pumping station. The electric light plant and water works station will be located on the same plot. A day service will be established in connection with the municipal electric light plant.

DALTON, GA.—Sealed proposals will be received by the Mayor and Board of Aldermen, Dalton, Ga., until Feb. 24 for furnishing material and construction work for the proposed extensions to the municipal electric light plant and water-works system and for construction of water-works pumping station and electric plant at Dalton, as follows: For furnishing approximately 225 tons 10, 8 and 6 in. cast-iron pipe and approximately 7 tons of special castings; 8 hydrants, 26 valves and 15 valve boxes; 1 150-hp boiler; 1 300-hp feed-water heater; 2 turbine pumps with direct-connected induction motors; 2 compound condensing engines with condensers; 2 150-kw alternating-current generators with a 5-panel switchboard; 1 35-arc regulator; building reinforced-concrete reservoirs and filter, power house and pumping station; erecting machinery and doing electrical construction work. Bids will be received for the whole or any part of the above work. Plans and specifications may be seen at the offices of the H. S. Jaudon Engineering Company, engineers, Savannah, Ga.; Atlanta, Ga., and at the office of W. M. Carroll, city clerk, Dalton, Ga. Copies of specifications may be obtained from the engineers by addressing them at Box 227, Dalton, Ga. Plans may be obtained by making a deposit of $25. Paul B. Trammel is Mayor.

BOISE, IDAHO.—The Boise Power, Light & Traction Company, which is making preparations for the construction of a large power plant on the Payette River, above Horseshoe Bend, and erection of transmission lines through the southern part of Idaho, states that its plans call for an ultimate development of 12,000 hp. The initial installation will provide for 5000 hp. A. L. Woodhouse is not general superintendent of the company, as reported in the issue of Jan. 12. M. M. Myers is secretary of the Boise Power, Light & Traction Company.

GRANGEVILLE, IDAHO.—The Grangeville Electric Light & Power Company is installing a hydroelectric unit consisting of a 500-hp Pelton-Francis turbine direct connected to a Westinghouse generator operating under a head of 59 ft. The wheel is of the double-runner cylindrical-case type. This plant supplies electricity for lamps and motors in Grangeville and the surrounding mining districts.

CARLINVILLE, ILL.—Bids will be received by the Board of Management of the Macoupin County Almshouse at the office of W. C. Seehausen, county clerk, until Feb. 7, for installing a lighting plant in the Macoupin Almshouse, specification for which may be obtained at the office of the county clerk.

COAL CITY, ILL.—Arrangements are being made by the Economy Light & Power Company, of Joliet, Ill., for the construction of a new power plant in Coal City, work on which will begin in the near future.

GIBSON, ILL.—The control of the Gibson Electric Light & Power Company, of Gibson, Ill., has changed hands. The new owners took possession of the property, which will be enlarged and improved under the direction of F. J. Postel, of Chicago, Ill., consulting engineer, who will serve as manager. The company supplies commercial and street lighting. A day service has already been established and special attention will be given to building up this end of the business.

BEDFORD, IND.—The City Council has decided to install a complete electric system at the water-works pumping station, plans for which are being prepared by W. L. Hurd, chief engineer of the Indianapolis Water Board.

LOGANSPORT, IND.—The city officials have refused the offer of the Logansport Heating Company to take over the municipal electric plant and to supply the city with electricity generated at its own plant, asserting that it can furnish power to the city at less than one-half it now costs the city to operate the municipal plant. The city officials claim the plant has been on a paying basis since 1905, the revenue from the plant being sufficient to purchase the machinery and rebuild the power house.

NOBLESVILLE, IND.—The Indiana Supreme Court has handed down a decision that the White River Light & Power Company, of Noblesville, Ind., is not prevented from the condemnation of land for a dam and backwater reservoir under the Act of 1909, granting the right to companies generating electricity.

PERU, IND.—The City Council is reported to have decided to install considerable new machinery and equipment in the municipal electric-light plant.

RICHMOND, IND.—The annual report of the municipal electric-light plant shows the total receipts for the year 1910 to have been $77,341 and the operating expenses $48,649, making the net earnings $28,692.

BURLINGTON, IA.—The construction of a power plant to develop from 50,000 to 100,000 hp in Burlington is reported to be under consideration. J. W. Albright is interested in the project.

CEDAR RAPIDS, IA.—At the annual meeting of the Cedar Rapids & Marion Telephone Company the executive committee was authorized to make extensions and improvements to its system, involving an expenditure of $50,000. Extensions will be made to the west side cables and conduits. J. M. Rider, of Cedar Rapids, Ia., is secretary and treasurer.

CENTRAL CITY, IA.—The City Council is considering the proposition to grant a franchise to Fred J. Cross to install an electric light plant in Central City, which will be submitted to a vote of the people. It is reported that Mr. Cross proposes to install a plant to cost $30,000 if granted a franchise.

IOWA CITY, IA.—Plans have been prepared for the construction of a large dam across the river at Steamboat Rock.

IOWA CITY, IA.—The City Council is reported to be contemplating the installation of an additional boiler and generator at the municipal water-works station for the purpose of generating electricity for lighting the streets of the city. Estimates are now being secured by the Council for cost of the same.

IOWA FALLS, IA.—O. F. Peterson, of Des Moines, Ia., has applied to the City Council for a franchise to supply heat and light in Iowa Falls for a term of twenty-five years.

MANY, IA.—The construction of an electric-light plant, water-works system and ice factory is reported to be under consideration by the municipality.

NEW LONDON, IA.—The City Council is reported to have awarded a contract to Leonard Waller for the construction of a temporary building for the municipal electric light plant, which was recently destroyed by fire. Arrangements have been made for a generator. Preparations are being made by the Council for rebuilding the plant.

RED OAK, IA.—The installation of new boiler equipment during the coming summer is under consideration by the Red Oak Electric Company. S. F. Schadel is secretary and manager.

OTTAWA, KAN.—Negotiations are under way between the Board of Water and Light Commissioners and the City of Williamsburg, Kan., with a view of supplying electricity to the City of Williamsburg from the municipal electric-light plant in Ottawa. W. O. Myers is manager of the municipal electric plant.

SCOTT, KAN.—The City Council is contemplating granting a franchise for an electric light and power plant. For further information address W. I. Silvey, city clerk.

SPRINGHILL, KAN.—At a special election held recently the proposition to issue $6,000 in bonds, the proceeds to be used to install an electric-light plant, was carried.

WAMEGO, KAN.—Plans are being considered for the installation of a 200-kw single-phase generator, direct-connected to Corliss engine, in the municipal electric plant next spring. D. A. Course is superintendent.

CADIZ, KY.—Plans are being considered by A. P. White & Company for the construction of a flour mill with an output of 150 barrels and an elevator having a capacity of 50,000 bu. The company proposes to build a hydroelectric power plant to supply electricity for operating the mill and also for other manufacturing plants and for lighting.

CALHOUN, KY.—Owing to the City Council and the Green River Light & Water Company being unable to come to an agreement in re-

gard to rates the company has discontinued the street-lighting service and the use of water for fire protection. The Council refused to pay the rates demanded by the company.

DAYTON, KY.—The City Council has accepted the bid of the Union Light, Heat & Power Company, of Covington, Ky., for a twenty-year franchise in the City of Dayton. Under the terms of the franchise the company is to supply electricity to the residents of Dayton at the same rate given to the citizens of Newport. The city is also to receive a cash bonus of $200. The contract is to go into effect June 1, 1911.

GRAYSON, KY.—The Home Light Company is contemplating installing a larger plant provided it can dispose of the present equipment, which is in good condition. It is proposed to install generating equipment of sufficient output to provide for 1000 lamps of 16 cp and an 80-hp boiler. J. A. Bagby is secretary and manager.

HICKMAN, KY.—The Hickman Ice & Coal Company is preparing to establish a day service this season and is also contemplating the installation of a direct-connected unit, either a 100 or 150-kw alternating-current, 3-phase, 60-cycle generator. J. T. Dillon is manager.

SOMERSET, KY.—The plant and holdings of the Somerset Water, Light & Traction Company have been purchased by Joseph H. Gibson and associates for $78,000. The property includes the water-works system and pumping station, street railway, electric-light plant and ice factory. Improvements will be made to the property, involving an expenditure of about $50,000, and will include a new filter plant and engine.

AUGUSTA, MAINE.—The Moosehead Power Company will apply to the Maine Legislature for a charter to authorize the company to develop the water power on the Kennebec River between Moosehead Lake and the forks at the junction of the Dead River with the Kennebec, about forty miles above Waterville. Henry L. Harriman, of Chase & Harriman, 50 State Street, Boston, Mass., is reported to be interested in the project.

BRIDGEWATER, MASS.—The Bridgewater Electric Company is planning to extend its transmission lines to Prattown to supply electricity in that district.

BROOKHAVEN, MASS.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until March 8 for construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, of the United States post office building at Brookhaven, Mass., in accordance with drawings and specifications, copies of which may be obtained at the above office or from the custodian of site at Brookhaven, Mass. James Knox Taylor is Supervising Architect.

LYNN, MASS.—The State Board of Gas and Electric Light Commissioners has approved the issue of 1800 additional shares of capital stock, at $235 per share, as determined by the directors. The proceeds of 120 shares are to be used to take up bonds to the amount of $10,000 issued by the Marblehead Gas & Electric Light Company and other indebtedness of that company, amounting to $18,200, the payment of which was assumed by the Lynn Gas & Electric Company when the plant was purchased; the proceeds of 540 shares to be applied to obligations of the Lynn company on account of plant improvements; the proceeds of 180 shares for indebtedness incurred in improvements to the Marblehead plant, and the proceeds of 910 shares to be applied to further improvements and additions to plants.

MIDDLEBORO, MASS.—The residents of the Fall Brook and Rock districts have petitioned the Municipal Lighting Commissioners to extend the electric lighting service to those districts. The commissioners have agreed to extend the transmission lines, provided twenty subscribers can be secured between the present terminus of the line and the proposed extension.

MILFORD, MASS.—Plans are being prepared by the Milford Electric Light & Power Company for remodeling its systems in Milford and Hopedale at a cost of about $150,000. Improvements will be made to both the gas and electric systems.

NORTH ADAMS, MASS.—The Windsor Print Works has decided to install electric motors to operate various parts of its plant and machinery. Electricity will be furnished by the North Adams Gas Light Company. The present steam plant will be retained and a portion of the mill will be operated by steam. About thirty motors, aggregating 500 hp, will be installed.

DELANO, MICH.—Plans are being considered by the Board of Trustees to build and equip an entire new plant to replace the present municipal electric plant next summer. N. G. Sandberg is superintendent.

DETROIT, MICH.—The Public Lighting Commission has purchased the Fairview arc lamp circuit from the Edison Illuminating Company. At the time the village was annexed to Detroit the Edison company held the contract for street lighting, which was taken over by the City of Detroit.

ISHPEMING, MICH.—The Marquette County Telephone Company is planning extensive improvements to its system which will involve an expenditure of about $25,000. A. B. Miner is secretary.

ANOKA, MINN.—It is reported that the Great Northern Development Company, of Duluth, Minn., has been authorized to construct a dam at Coon Rapids, which, with the one to be erected in Anoka, will develop 35,000 hp.

IRON MOUNTAIN, MINN.—The Oliver Mining Company is reported to be building a power dam on the Menominee River, four miles above Iron Mountain, at a cost of $750,000.

MINNEAPOLIS, MINN.—The Minnesota & Ontario Power Company is reported to be contemplating the construction of a dam to develop power at Kettle Falls.

MINNEAPOLIS, MINN.—The Minneapolis General Electric Company is reported to have purchased extensive water rights on the St. Croix and Mississippi Rivers which will be developed as needed. The holdings include riparian rights and the dam sites, located several miles above St. Croix Falls, near Otsego, and in the villages of Clearwater and Monticello, together with the power development at Taylor's Falls and Minneapolis. It is proposed to erect a plant at St. Croix Falls, which will be a duplicate of the Taylor's Falls plant, which has an output of 25,000 hp.

ST. PETER, MINN.—Plans are being considered by the Water and Light Department for improvements and extensions to the municipal electric light system, which will include the reconstruction of most of the pole line, changing from streets to alleys; the installation of two additional motors, of 15 and 25 hp respectively, at Kasota, in March, which will necessitate the erection of additional pole line in that place, and the installation of transformers with a rating of 30 kw. Changes will also be made in the power house and the street lighting system in St. Peter, changing from series open arc to series Mazda lamps. William Eldred is manager.

VIRGINIA, MINN.—Plans are being considered by the Board of Education for the installation of private lighting system for the Roosevelt and the Technical High School Building, to cost about $14,000.

WADENA, MINN.—The Village Council is reported to have decided to erect a brick smokestack, 60 ft. x 80 ft., at the municipal electric-light plant.

HATTIESBURG, MISS.—Plans are being considered by W. S. F. and W. O. Tatum, of Hattiesburg, Miss., who were granted a franchise some time ago by the City Council to construct and operate a street railway and electric-light plant in this city, to begin work on construction of the same some time during this year.

AURORA, MO.—The citizens on Jan. 19 voted to grant a franchise to the Lawrence County Water, Light & Cold Storage Company to construct and operate electric and water plants in Marion. The company proposes to install a plant in Aurora at a cost of about $40,000.

McPHERSON, MO.—The Water and Light Commission is making investigations with the view of establishing a municipal electric light plant in McPherson.

ST. LOUIS, MO.—Arrangements are being made by property owners on Jefferson Avenue to install electroliers similar to those in use on Grand and Vandeventer Avenues. The cost of installing the standards and maintaining the lamps for one year will be paid by the property owners, and then it is proposed to ask the city to include the maintenance of the lamps in the general lighting fund.

KEARNEY, NEB.—The Federal Light & Traction Company is erecting a hydroelectric plant at Kearney, Wyo. About 1200 kw will be developed.

NORFOLK, NEB.—The City Council is considering the question of installing a municipal electric light plant in Norfolk. A special election will probably be called to vote on the proposition to issue $55,000 in bonds to pay for same.

PITMAN GROVE, N. J.—The Public Utility Commission has approved an ordinance passed by the Township Committee of Deptford, granting the Gloucester County Electric Company permission to erect a distributing system to supply electricity for lamps and motors in that town.

ALBUQUERQUE, N. M.—The Nash Electric Company, of Albuquerque, N. M., has been awarded the contract for the installation of electric power equipment in the new vanadium oxide plant, including generator, wiring, etc. W. A. Bonitz is vice-president and manager of the Vanadium Mines Company.

PORTALES, N. M.—Plans are being considered by the American Beet Sugar Company for the erection of a large beet sugar factory in Portales, N. M., and the installation of a large electric power plant and to construct an electric railway from Portales to Taiban, N. M., traversing the center of the proposed sugar beet district. The railway will provide both passenger and freight service. The company also proposes to dig the wells for the farmers, install electric irrigating pumping plants, the cost of the latter to be paid by the farmer in twenty annual installments without interest.

ALBANY, N. Y.—Proposals will be received by the Board of Contract and Supply, Albany, N. Y., until Feb. 6 for lighting the streets of the city for a term of five years from June 21, 1911. Isidore Wachsman is secretary of the board.

BUFFALO, N. Y.—The Committee on Water of the City Council and the Commissioners of Public Works have approved the purchase of three steam turbo-generators with a rating of 5000 hp each for the new water-works pumping station from the Westinghouse Machine Company, of Pittsburgh, Pa., for $248,180. The generators will supply electricity for lighting the municipal buildings and streets in addition to operating water-works pumps.

EAST QUOGUE, N. Y.—It is reported that the village of East Quogue has decided to establish a lighting district and will enter into a contract with the Suffolk Light, Heat & Power Company for a period of five years for street lighting, with an option of extending the contract five years at the same price. Under the terms of the contract the company is to furnish forty incandescent street lamps at $18 each per year.

ITHACA, N. Y.—The Public Service Commission has authorized the Ithaca-Auburn Power Company to execute and issue a first-lien mortgage

upon all its property to secure an issue in bonds to the amount of $750,000 and to issue $50,000 in capital stock. The company is authorized to issue presently bonds to the amount of $433,000, to be sold at not less than 85, the proceeds to be used for the acquisition of certain property from H. C. Mandeville, of Ithaca, for $100,000, for material and construction of an additional steam power plant, to cost $95,000, and for the construction of its distributing line and third-rail system for the New York, Auburn & Lansing Railroad Company, at a cost of $201,000.

NEWARK, N. Y.—The directors of the Wayne Telephone Company have approved plans for extensions and improvements to its system throughout the county which will involve an expenditure of about $55,000. The plans include improvements to the local system.

NEW YORK, N. Y.—Plans are being prepared by the New York Telephone Company for the erection of a fifteen-story telephone exchange building, with adequate foundation for twenty-five stories. The cost of the building with equipment is estimated at about $2,000,000.

CHARLOTTE, N. C.—The entire properties of the Charlotte Consolidated Construction Company, including the Charlotte Street Railway and the Charlotte Gas & Electric Company, have been transferred to the Southern Power Company interests, which were purchased some time ago. E. D. Latta, president of the Charlotte Electric Railway, Light & Power Company, will have charge of the local plants. The Southern Power Company now controls the electric railways, city and suburban, in Anderson, S. C.; Greenville, S. C., and Charlotte, N. C., and is building an interurban railway from Anderson, N. C., via Greenville, S. C., and Spartanburg, Gastonia, Charlotte, Greensboro and Durham, a total distance of 300 miles.

ARLINGTON, OHIO.—The Board of Public Affairs is planning to install a return tubular boiler, 72 ft. x 16 ft., and a water softener in the municipal electric plant during the coming year. R. E. Dillon is superintendent.

CLEVELAND, OHIO.—The stockholders of the Cleveland Railway Company on Jan. 26 authorized an issue of $35,000,000 in bonds. J. J. Stanley was re-elected president, and C. F. Emery and R. A. Harman, vice-presidents.

CLEVELAND, OHIO.—Bids will be received at the office of the Director of Public Service, City Hall, Cleveland, Ohio, until Feb. 7 for furnishing heat, light and power for the City Hall building. A. B. Lea is Director of Public Works.

DAYTON, OHIO.—The contract for the erection of a large addition to the Beaver power building in Dayton, Ohio, has been awarded to A. Bentley & Sons, of Toledo, Ohio.

PAWHUSKA, OKLA.—The Pawhuska Water and Light Department is contemplating the installation of 12,000 ft. of No. 2 copper primary circuit, and is in the market for a second-hand, 125-150-volt, single-phase, 60-cycle alternator, revolving armature, compound wound, Westinghouse or General Electric make preferred. L. P. Caldwell is superintendent.

RYAN, OKLA.—J. M. Thomas and associates are preparing plans for the construction of a 15-ton ice plant to be operated in conjunction with the municipal electric light plant. They propose to purchase steam power from the municipal plant. A day service will be established beginning about the middle of March. The Water and Light Department is contemplating submitting a proposition to the towns of Sugden and Terrell in the near future to extend its transmission lines to those places to supply electricity for lamps. J. M. Thomas is superintendent of the municipal plant.

ARLINGTON, ORE.—The City Council is reported to be considering the question of establishing a municipal electric-light plant in Arlington.

ASTORIA, ORE.—Plans are being made by the Nehalem Valley residents to organize a telephone company which will be known as the Nehalem Valley Telephone Company to build a telephone line from Astoria to Elsie, via Jewell, a distance of about forty miles. The company will be capitalized at $3,000. David Tweedle and James Jamieson are interested in the project.

COTTAGE GROVE, ORE.—The Cottage Grove Electric Company has been granted a twenty-five-year franchise. The company recently submitted a proposition to the City Council agreeing to make extensions and improvements to its system, involving an expenditure of $12,000, provided an extension to its present franchise was granted.

EUGENE, ORE.—Steps have been taken by the City Council for the installation of a municipal electric light system. The proposition to install a municipal plant will be submitted to the voters at the April election. The cost of the plant is estimated at from $15,000 to $30,000.

COATESVILLE, PA.—It is reported that application has been made at Harrisburg for a charter for the Chester Valley Electric Company by Philadelphia and New York capitalists, who have acquired several electric light and power plants in Chester County. It is said that the capital stock will be placed at $1,000,000 and $750,000 in bonds will be issued. The proceeds of the bonds will be used to erect a large power plant on Brandywine Creek, near Coatesville. The officers of the company are: A. B. Beadle, of New York, N. Y., president; W. W. Levering, of Philadelphia, Pa., secretary and treasurer, and J. Owen Roberts, of Philadelphia, Pa., counsel.

EBENSBURG, PA.—The Ebensburg Light, Heat & Power Company is reported to be contemplating improvements to its plant, including the installation of two generators.

INTERCOURSE, PA.—Preparations are being made by the Intercourse Electric Light, Heat & Power Company for extending its system to cover a large teritory in the vicinity of Mechanicsburg and New Holland. The company is contemplating shutting down its present power plant and securing energy for operating its system from a large power company in that vicinity. Enos L. Zimmerman is secretary and treasurer.

PHILADELPHIA, PA.—The Philadelphia Electric Company has purchased a site at the corner of Jefferson and Thirtieth streets, on which, it is reported, it will erect an auxiliary power plant.

PHILADELPHIA, PA.—An ordinance has been submitted to the Council asking for 125 additional lamps to be placed on Fifty-second Street north of Market Street, and twenty-one on Market Street between Fiftieth and Fifty-fourth Streets. A special communication was also submitted to the Council by Mayor Reyburn making a request for the twenty-one lamps on Market Street and for 100 additional lamps on Fifty-second Street south of Market Street.

PITTSBURGH, PA.—The Aluminum Company of America, Park Building, Pittsburgh, Pa., is reported to be contemplating the construction of a hydroelectric power plant on Little Tennessee River, for which preliminary surveys are being made and land and water rights purchased. As yet nothing definite has been determined on.

POTTSTOWN, PA.—Preparations are being made by the Philadelphia Suburban Gas & Electric Company for the erection of a new power house in Pottstown. The company will also build a substation in Sanatoga, Pa.

WARREN, PA.—The Warren & Jamestown Street Railway Company is planning to change its system from single-phase, alternating-current to direct-curent system, which will necessitate the construction of two new rotary converter substations, which will probably be located at Frewsburg and North Warren.

YORK, PA.—Preparations are being made by the Edison Electric Light Company for the construction of a new steam power plant, to be erected on North Water Street, York. The contract for the engineering work has been awarded to Westinghouse, Church, Kerr & Company, of New York, N. Y. A 2000-kw generating unit will be installed. When the new power station is completed the present plant will be used as an auxiliary plant. Gordon Campbell is president and manager.

CHARLESTON, S. C.—The City Council has engaged Rudolph Hering, of New York, N. Y., consulting engineer, to make investigations and prepare estimates on the cost of a new water and light plant for the city.

NEWBERRY, S. C.—The Southern Power Company has applied to the City Council for a sixty-year franchise in Newberry. The company has contracts to furnish electricity to operate the Mollohon Cotton Mill, the Oakland Mill, now in course of construction, and for the recent addition to the Newberry Mill. The company is extending its transmission line to Newberry, via Union and Whitmire. Preparations have been made for the erection of a substation in Newberry and the company is awaiting the action of the Council to begin work on same. It is expected to have the line completed by April 1.

SPARTANBURG, S. C.—The Spartanburg Railway, Gas & Electric Company, which is owned and operated by the Electric Power & Manufacturing Company, is contemplating further hydroelectric developments and extensions to its electric railways. The company has acquired the Palmer Shoals on the Broad River and the Nesbit Shoals on the Tiger River and another undeveloped water-power in the mountains which it proposes to utilize. It is proposed to extend the Clifton railway to Cowpens, two miles distanct, and the East Main Street line across Lawson's Fork and to Whitney; from there it is proposed to return by the water-works and join the North Church Street line. R. C. Crawford, of Pittsburgh, Pa., is president, and F. H. Knox, of Spartanburg, S. C., is vice-president and general manager.

SUMTER, S. C.—The plant and holdings of the Sumter Ice, Light & Power Company are reported to have been sold to Philadelphia interests. It is understood that the consideration was $150,000.

HENRY, S. D.—The City Council is reported to have granted a franchise to the Henry Light & Power Company to install an electric light system in Henry.

MENNO, S. D.—Peter A. Orth has been granted a franchise to install an electric-light franchise in Menno.

COAL CREEK, TENN.—The Coal Creek Electric Light Company is making arrangements to install an ice plant and laundry in connection with its electric plant in the near future. J. P. Stanton is secretary and manager.

MURFREESBORO, TENN.—Preparations are being made by the Davis Elam Gas & Electric Company for the installation of a new plant in the near future.

NASHVILLE, TENN.—Arrangements are being made by the promoters of the Nashville-Gallatin Interurban Railway for selecting the route and making surveys for the proposed railway. It is expected that work on the road will begin in May. H. H. Mayberry is interested in the project.

BRYAN, TEX.—It is reported that J. T. Lawler, of New Orleans, La., who is planning to establish a flour mill in Bryan, proposes to install an electric plant and supply electricity in this city.

CELINA, TEX.—The Celina Electric Light & Power Company, recently incorporated, has been granted a franchise to construct and operate an electric-light plant in Celina.

CENTER, TEX.—The Center Ice, Light & Power Company has recently purchased a twenty-ton ice plant from the York Manufacturing Company, of York, Pa.

CLARKSVILLE, TEX.—The Clarksville Light Company has recently placed a contract with the York Manufacturing Company, of York, Pa., for a forty-five-ton compression side, ten-ton freezing system and twenty-five-ton distilling system.

COMMERCE, TEX.—The Commerce Ice & Power Company is contemplating the installation of another generator soon and making extensive improvements and extensions to its system. T. W. Smith is manager.

EAGLE LAKE, TEX.—The Eagle Lake Manufacturing Company is contemplating changing its system to 60 cycles and establishing a twenty-four-hour service. A. H. Koennecke is proprietor and manager.

GLEN ROSE, TEX.—Woodford M. Davis, of Dallas, Tex., is reported to be contemplating the construction of a dam across the Paluxy River nad building a hydroelectric power plant.

MADISONVILLE, TEX.—C. C. Murray & Sons, who have recently been granted a franchise to install an electric-light plant in Madisonville, will begin work at once on construction of same. The plant will have sufficient output to provide for 1500 lamps of 16 cp. A company will be formed under the name of the Madisonville Light & Power Company to operate the plant. It is understood that an ice plant may be installed in the near future.

PECOS, TEX.—The Barstow telephone system, which operates in the Barstow section of the Pecos Valley, has been purchased by J. G. Gaither, president and principal stockholder of the Reeves County Telephone Company, which operates in the lower section of the Pecos Valley, with exchanges in Pecos, Yovah and Balmorehea.

PROVIDENCE, TEX.—The Provident Land Company, which proposes to erect a fig-preserving plant in Providence, is reported to be interested in the installation of an electric-light plant.

TEMPLE, TEX.—The Gulf, Colorado & Santa Fé Railroad Company, which is planning to make improvements to its local shops, including the installation of additional machinery, is reported to be contemplating the installation of an electric light and power plant and also a steam-heating plant.

SPRINGVILLE, UTAH.—Owing to the present plant being unable to meet the demands made upon it, plans are being considered for the installation of a new municipal electric plant with an output of from 250 to 500 kw. The present plant has an output of 100 kw. The present plans call for a new pipe line, pressure pipe, water wheel, generators, switchboard, etc. Myron Manwaring is superintendent.

BURLINGTON, VT.—The Board of Aldermen has adopted a resolution authorizing the purchase of additional equipment for the municipal electric light plant, the cost not to exceed $27,000. The Electric Light Commissioners will soon call for bids for the installation of a new steam turbine.

FREDERICKSBURG, VA.—Application has been made to the City Council by C. P. Burgwyn, president of the Rappahannock Electric Light & Power Company, for an electric-light franchise in Fredericksburg.

MONTEREY, VA.—The W. F. Kyle Light & Plumbing Company is contemplating duplicating the present equipment of the plant. The plant is driven by a gasoline engine. W. F. Kyle is owner and manager.

METALINE, WASH.—It is reported that a franchise has been granted to W. W. Warner, representing the Sterling Silver Lead Company, to install electric light and power and telephone systems and to construct a water-works plant in Metaline.

NORTH YAKIMA, WASH.—The Pacific Power & Light Company has applied to the Board of County Supervisors for a franchise to erect thirty miles of pole line to supply electricity for lamps and motors for its telephone properties.

PASCO, WASH.—Plans are being prepared by the Hanford Irrigation & Power Company for extensions and improvements to its property in the valley and the construction of a hydroelectric power plant at Priest Rapids, enlarging and remodeling the pumping station at Coyote Rapids, increasing the capacity of the irrigating canal and the erection of a transmission line from Hanford down the river. New machinery will be installed in the power house at Priest Rapids.

SEATTLE, WASH.—At an election to be held March 7 the proposition to issue $800,000 in bonds, the proceeds to be used to purchase the equipment of the Seattle, Renton & Southern Railway Company, will be submitted to a vote. The City Council recently revoked the franchise of the company.

SEATTLE, WASH.—It is reported that the Board of Public Works has passed favorably on the proposition to construct a hydroelectric power plant on Lake Union, utilizing the waste water. It is expected that a large reservoir will be built in Volunteer Park and a steel pipe installed to convey the water to the plant. It is estimated that 2000 hp could be developed.

TACOMA, WASH.—The Metropolitan Park Commissioners have authorized Frederick Heath, acting president, to call for bids for ornamental lamp standards, lamps, wiring, etc., necessary for lighting Wright Park.

WARDEN, WASH.—Local business men are contemplating the installation of a telephone system in Warden.

FOLLANSBEE, W. VA.—The Council has granted the Steubenville & East Liverpool Railway & Light Company, of Steubenville, Ohio., a franchise to construct and operate an electric-light and power system in Follansbee for a period of thirty years. Under the terms of the franchise the company is to supply electricity for lighting the city buildings at the rate of 4 cents per kw-hour and 2000-cp arc lamps for street lighting for $66 each per year, and 80-cp incandescent lamps at the rate of $34 per lamp per year. Street lamps will not be installed at present, as the town cannot supply all the lamps needed owing to financial conditions. The chief object in granting the franchise was to allow manufacturing plants to secure electricity for lamps and motors.

WHEELING, W. VA.—The City Council has granted the Wheeling Electrical Company a franchise to erect and operate a pumping station at its new power station at Forty-second Street. The franchise runs for a period of fifty years, and in addition the company has permission to erect and maintain necessary wires and conduits. In consideration for the franchise the company is to pay the city $100 annually and to supply electricity for lamps for the Second and Fifth ward market houses free of charge.

COLUMBUS, WIS.—Bids will be received by R. J. Lueders, clerk, until Feb. 7 for the reconstruction of power house of the municipal electric-light system.

MILWAUKEE, WIS.—The finance committee of the Common Council is reported to have made provision for an issue of bonds to the amount of $300,000 for the proposed municipal electric light and power plant, this sum forming the initial appropriation for same. Harry E. Briggs is Commissioner of Public Works.

MILWAUKEE, WIS.—The Board of County Commissioners of Milwaukee County has rejected all bids submitted for lighting the new $1,500,000 Grand Avenue viaduct by electricity. Vaughn & Meyer, consulting engineers, 909 Majestic Building, Milwaukee, Wis., have been authorized to submit plans for lighting the bridge.

MOSINEE, WIS.—The establishment of an electric-light plant in Mosinee is reported to be under consideration.

WESTFIELD, WIS.—Plans are being prepared by the Westfield Milling & Electric Light Company for the construction of a new power plant this year at an estimated cost of $5,000. A new 100-hp water wheel will be installed. A new building will be erected adjoining the present power house. Clark Older is secretary and purchasing agent.

CASPER, WYO.—It is reported that the promoters of the Nebraska Coal & Power Company, recently organized, have made arrangements with an English syndicate to finance its project. The company proposes to construct an electric railway from Casper, Wyo., to Rawlins, Baggs and Dixon, all in Wyoming, and possibly to reach some towns in northern Colorado. The present plans include the erection of a large hydroelectric plant on the North Platte River and probably later on another plant on the Little Snake River. The company also proposes to supply electricity to mines and farmers along its lines. H. A. R. Gray is general manager.

CALGARY, ALTA., CAN.—The contract for equipment for the municipal electric plant is reported to have been awarded to Chapman & Walker, of Toronto, Ont., and includes one 1500-hp, 2300-volt, 3-phase, 60-cycle, 400 r.p.m. synchronous motor direct-connected to a 100-kw direct-current, 550-660-volt generator; one 200-kw motor generator exciter set, manufactured by Dick, Kerr & Company, Ltd., and complete switchboard apparatus, made by Cowans, Ltd., of Manchester, England.

STRATHCONA, ALTA., CAN.—It is reported that new machinery for the municipal electric-light plant has been recommended, to cost approximately $65,000.

STRATHCONA, ALTA, CAN.—Tenders will be received by David Ewing, chief engineer power house, municipal electric light plant, until March 1 for engine, boilers and generators, specifications for which may be obtained upon application to A. J. McLean, city engineer.

PORTAGE LA PRAIRIE, MAN., CAN.—The City Council has appointed a special committee to make investigations with the view of establishing an electric-light and gas plant to be owned and operated by the municipality.

ARNPRIOR, ONT., CAN.—The by-law authorizing the use of electricity for pumping water was carried. It is proposed to erect a hydroelectric plant on the Mississippi River at Galetta, which will be done by a private corporation.

HAMILTON, ONT., CAN.—Plans are being considered for the installation of equipment at the sewerage disposal pumping plant at the Beach. Electricity for operating the plant will be supplied by the Hydro-Electric Power Commission.

KINGSTON, ONT., CAN.—Alderman R. F. Elliott, chairman of the Civil Light, Heat and Power Committee, of Kingston, has been consulting with Adam Beck, chairman of the Hydro-Electric Power Commission, with a view of obtaining electricity for Kingston and other points in eastern Ontario. The commission, it is stated, hopes to secure power from Waddington, N. Y., for which investigations are being made to prepare plans and estimates of cost for same.

OTTAWA, ONT., CAN.—Engineers are now investigating the feasibility of developing a water-power on the Rideau River at Hog's Back, on the outskirts of the city. It is claimed that there would be a 30-ft. head available for power development.

STRATHROY, ONT., CAN.—The commissioners of the municipal electric-light and water plant are in the market for a 250-hp engine. A. MacLachian is superintendent.

TORONTO, ONT., CAN.—The City of Toronto will soon issue bonds to the amount of $1,000,000 to pay for installing the hydroelectric system in this city. Up to the present time $700,000 has been spent on the system within the city limits, which has been obtained by means of local

loans; the proceeds of the bond issue will be used to carry the work forward.

TORONTO, ONT., CAN.—An important amendment to the Provincial Hydroelectric Act is under consideration by the Hydro-Electric Power Commission, under which provision will be made to supply farmers directly with electricity at their homes, which it is expected will be introduced to the present session of the Legislature. It is expected that a test of power for farm work will be made at the Ontario Agriculture College at Guelph, and after that it will be tried at private farms near Tilsonburg.

MEXICO CITY, MEX.—It is stated that the Canadian syndicate headed by Sir William Mackenzie, of Toronto, Ont., Can., which already owns extensive electric-light and railway systems in Monterey, Mex., has acquired the concession that was granted by the government some time ago for the construction of a large dam across the Balsas River and the installation of a hydroelectric power plant in the State of Guerrero. It is reported that the contract for construction of the dam has been awarded and will cost about $3,000,000 in gold. The proposed dam will be located in the canon of the river near the end of the Cueravaca, Mexico & Pacific division of the National Railways of Mexico.

New Industrial Companies.

THE AMMER SIGN COMPANY, of Buffalo, N. Y., has been incorporated with a capital stock of $5,000 to deal in electrical signs, advertising, etc. The incorporators are: Albert Ammer, Herbert A. Combes, both of 817 Main Street; George E. Koch, 512 Brisbane Building, all of Buffalo, N. Y.

THE BRUCE-HIBBARD ELECTRIC COMPANY, of Fitchburg, Mass., has filed articles of incorporation with a capital stock of $50,000. The company controls the Leominster Electric Company and also has branches in Athol and Marlboro. The officers of the company are: Edward Bruce, of Fitchburg, Mass., president and treasurer; Albert E. Huestis, vice-president, and Paul Fielden, clerk.

THE CHILDS ELECTRIC WIND TURBINE COMPANY, of Dover, Del., has been incorporated with a capital stock of $2,000,000 by R. W. France, of Brooklyn, N. Y; L. A. Watson and C. H. Kulberg, both of New York, N. Y.

THE CLARK-NORWALK COMPANY, of Brooklyn, N. Y., has been incorporated by Harry Meinken, 1373 Dean Street, Brooklyn, N. Y.; E. M. Sceacht, Joseph G. Quinn, Jr., of 257 Broadway, New York, N. Y. The company is capitalized at $3,000 and proposes to manufacture motors, engines, vehicles, etc.

THE C. R. G. MANUFACTURING COMPANY, of Saugus, Mass., has been incorporated with a capital stock of $100,000 for the purpose of manufacturing engines, motors, etc. The officers are: C. R. Gunter, of Saugus, president, and R. A. Faye, of Boston, Mass., treasurer.

THE ELECTRIC MAGNET TOOL COMPANY, of San Francisco, Cal., has been incorporated with a capital stock of $200,000 by C. E. Frederickson, E. D. McCallam and G. S. Chamberlain.

THE ELECTRIC PROCESSING COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $5,000,000. The incorporators are: L. Jones, B. E. Hughes, A. J. Carroll, of Louisville, Ky.

THE FORD METER MANUFACTURING COMPANY, of Wabash, Ind., has been incorporated with a capital stock of $25,000 to manufacture water, gas and electric meters by E. H. Ford, T. W. McNamee and W. A. McNamee.

THE HANCOCK-HOWELL ELECTRICAL ENGINEERING COMPANY, of Buffalo, N. Y., has been chartered by Wheeler W. Hancock, Herbert H. Howell and George C. Hillman, all of Buffalo, N. Y. The company is capitalized at $5,000 and proposes to do a general contracting, electrical and mechanical engineering business.

THE HOYT ELECTRIC SALES COMPANY, of Indianapolis, Ind., has been incorporated with a capital stock of $20,000 by Francis R. Hoyt, David A. Myers and Harry A. Fenton. The company proposes to handle the entire output of the Hoyt Electric Company and also a certain device made by the company for lighting all kinds of self-propelled vehicles and other motor vehicles.

THE INTERSTATE ELECTRIC COMPANY, of Chicago, Ill., has been chartered with a capital stock of $2,500 by C. J. Huff, George Hornecker and Mrs. M. B. Huff. The company proposes to do a general electrical contracting business.

THE KIRTLAND ELECTRIC CONSTRUCTION COMPANY, of Albany, N. Y., has been granted a charter with a capital stock of $2,500. The company proposes to do a general contracting business and electrical work of all kinds. The incorporators are: Frank C. Kirtland, of Albany, N. Y.; Herbert E. Kirtland, of Rensselaer, N. Y., and Paul C. Heath, of Albany, N. Y.

THE RAILWAY BUILDING COMPANY, of New York, N. Y., has been granted a charter with a capital stock of $50,000 to do a general railway engineering and construction business and to deal in railway equipment and supplies. The incorporators are: Berkley C. Austin, Eugene W. Austin, both 76 William Street, and Walter L. Brunnell, 317 West 136th Street, all of New York, N. Y.

THE UNITED FUEL ECONOMIZER COMPANY has filed articles of incorporation with the Secretary of State with a capital stock of $150,000. The company proposes to act as selling agent for manufacturers of fuel-saving devices. The incorporators are: T. Bromley, Jr., H. C. Wagner and F. Balcom.

THE WHITE STAR MOTOR & ENGINEERING COMPANY, of Brooklyn, N. Y., has been incorporated with a capital stock of $3,000 by John T. Whalen, 1158 Dean Street, Robert J. Reutal, 120 Crystal Street, both of Brooklyn, N. Y., and George H. Beutel, 108 George Street, Evergreen, Queens. The company proposes to manufacture engines, machinery, etc.

W. A. BIRDSALL & COMPANY, of Newark, N. J., have filed articles of incorporation with a capital stock of $75,000 for the purpose of manufacturing vacuum cleaning supplies, heating and plumbing apparatus. The incorporators are: W. A. Birdsall, P. D. Elliott and H. Russomann, of Newark, N. J.

New Incorporations.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed for the Sierra Blue Lakes Water & Power Company with a capital stock of $75,000 by Eugene J. Sullivan, Walter E. Sullivan and George H. Richardson. The company proposes to operate water and irrigation plants and supply electricity and water power. It also claims to own rights to the waters in Blue Lakes and the Mokelumne River, which it proposes to offer to the City of San Francisco, Cal., for $6,000,000.

MANASSA, COL.—The Manassa Milling & Electric Company has been incorporated with a capital stock of $50,000 by Samuel Jackson, Jr., Stephen A. Smith and James H. Elledge.

VINCENNES, IND.—The Vincennes Electric Company has filed articles of incorporation with the Secretary of State with a capital stock of $20,000. The company is operating an electric plant in Vincennes. The incorporators are: Albert J. Heintz, of Vincennes, Ind.; William T. Barnes and Charles W. Sherman, both of Boston, Mass.

RED CLOUD, NEB.—The East Garfield Telephone Company has been chartered with a capital stock of $10,000 by A. W. Shipman, I. H. Hawkins and Henry Emerton.

RED CLOUD, NEB.—The Nebraska & Kansas Telephone Company has been incorporated with a capital stock of $10,000 by W. G. Shannon, C. B. Steward and C. H. Arbuckle.

Personal.

MR. G. WILBUR HUBLEY, superintendent and engineer of the Louisville Lighting Company, was elected on Jan. 16 president of the Louisville Engineers and Architects' Club.

MR. THOMAS ROYCROFT, for many years superintendent of the Red River Power Company, has been elected superintendent of the Grand Forks (N. D.) Transit Company, to succeed Mr. A. W. Morrison, resigned.

MR. ARTHUR ORGUN, who was with the Jandus Electric Company until its recent consolidation with another concern, has entered in the general electrical supply business on his own account, with offices at 114 Liberty Street, New York.

MR. P. H. PALMER, electrical engineer of the Kokomo, Marion & Western Traction Company, gave an address Jan. 17 on "Power System Economics" before the Purdue Branch of the American Institute of Electrical Engineers, Lafayette, Ind.

MR. HAROLD KIRSCHBERG has resigned as illuminating engineer with the Pennsylvania Railroad Company to join the engineering staff of the Heany Company and its associated interests, the Novelty Incandescent Lamp Company and the Tipless Lamp Company.

MR. F. E. VOORHIES has resigned his position as superintendent of the Municipal Water Works and Electric Light Plant, Lafayette, La., to become consulting engineer for the cotton oil machinery trade. Mr. Voorhies is president of the Association of Cotton Oil Mill Superintendents.

MR. FRANK E. BROWN, formerly chief of the Department of Gas and Electricity, New York City, has joined with Mr. Halbert P. Hill to represent in the East the Triumph Electric Company and the General Concrete Construction Company. Mr. Brown will devote his time to large power-plant equipment.

MISS SARAH SHERIDAN, chief of the sales department of the Edison Electric Illuminating Company, of Detroit, has been appointed also to a similar position in the organization of the Eastern Michigan Electric Company, which serves the suburban territory within a radius of thirty miles of Detroit and is controlled by the Detroit company.

MR. R. C. LANPHIER, of the Sangamo Electric Company, Springfield, Ill., read a paper entitled "The Ampere-hour Meter for Electric Vehicles" at the annual meeting of the Society of Automobile Engineers, held at New York, Jan. 11 to 12. The paper gave a good many data as to the operation of electrically driven delivery wagons under commercial conditions.

MR. T. J. LYNCH, who for the past seven years has been manager of the Toronto office of Allis-Chalmers-Bullock, Limited, has been appointed manager of the Boston office of the Allis-Chalmers Company. Mr. Lynch was born and spent his early life in Boston and before going to Toronto was connected with the construction department of the Allis-Chalmers Company.

DR. EDWARD P. HYDE, of the National Electric Lamp Association, will deliver an experimental lecture on the physics of light sources before the Department of Electricity of the Brooklyn Institute of Arts and Sciences, on Wednesday evening, Feb. 8, at 8:15 o'clock, at the Academy of Music, Brooklyn, N. Y. All interested are invited. Subway cars may be taken to the Atlantic Avenue terminal, which is a short block from the Academy of Music.

MR. GEORGE WILLIAMS, connected with the firm of Henry L. Doherty & Company, lectured upon "Sign Lighting" before a large audience at the Twenty-third Street Branch of the Y. M. C. A. of New York City on Jan. 26. Mr. Williams claimed that many towns in the United States show proportionately much greater development in electrical sign display than does New York. The lecture was illustrated by stereopticon slides showing the "Great White Ways" of many of the best illuminated cities in the country.

MR. J. W. CUSHMAN, who for some time past has been special representative of the Fostoria Incandescent Lamp Company in North and South Carolina, has taken up a new position with the same company in Pennsylvania. Mr. E. V. Plane, the Fostoria representative in Georgia and Alabama, has taken Mr. Cushman's place in the Carolinas, while Mr. W. M. Tibbs, who for a number of years has been affiliated with various electrical interests in Knoxville, Tenn., will continue Mr. Plane's work in the middle South.

MR. EDWIN W. WINTER, for the past eight years president of the Brooklyn Rapid Transit Company, resigned his position on Jan. 27, to take effect immediately. Before coming to Brooklyn Mr. Winter had been connected with railroads for twenty-five years, having served as general superintendent and manager of the Chicago & Northwestern Railroad and president of the Northern Pacific Railroad. Under his presidency the Brooklyn Rapid Transit Company has been placed on a paying basis and obtained the general good will of the public, while he found it eight years ago staggering under a torrent of public condemnation and unable to pay any dividends.

MR. JOHN D. NIES, professor of electrical engineering in Lewis Institute, won the $2,500 electric automobile offered as first prize in the estimating contest at the Chicago Electrical Show. The task was to estimate the total number of feet of bare and covered wire on the four sections of an ornamental column that formed the central feature of the show. There were two layers of wire in each of the four sections, the insulated wire being underneath and invisible. The sections were tapering and the lowest one flared outwardly at the base in a slight curve. By an arithmetical calculation Professor Nies estimated the total length of wire at 19,415 ft. The measurement showed that the exact length was 19,416.1 ft. There were nearly 40,000 estimates of the length of the wire made in the competition.

MR. E. T. PARDEE, formerly manager of the Boston office of the Allis-Chalmers Company, has been appointed manager of the power and electrical department of the company at Milwaukee. Mr. Pardee was connected with the Western Union Telegraph Company at Syracuse, N. Y., from 1885 to 1891. Following this he represented the Fort Wayne Electric Corporation at Omaha and San Francisco from 1891 to 1898, being advanced in the latter year to manager of the Boston office, which position he held until 1901. In that year he entered the Boston office of the Bullock Electric Manufacturing Company as salesman and remained with the Allis-Chalmers Company in a similar capacity. Mr. Pardee was made manager of the Boston office of Allis-Chalmers Company in 1905.

PROF. MORGAN BROOKS, of the University of Illinois, addressed a joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers at a meeting held at the rooms of the latter in Chicago on Jan. 25. His title was "Inductions from a Closed Circuit of the Globe," and the lecture was based on observations and pictures gathered during a recent trip around the world. Professor Brooks said that the Japanese will soon do their own engineering work. In relation to the copying of machinery in that country the speaker pointed out that foreign inventors are to blame for not taking out patents in Japan. There are engineering colleges at Tokio and Kioto, and in their electrical laboratories are dynamos from Italy, France, Germany and England. In electrical matters the Japanese are well advanced.

MR. R. M. VAN VLEET, Chicago manager for the Cutler-Hammer Manufacturing Company since 1904, has left Chicago to take up work of greater responsibility in the executive offices of the same company at Milwaukee. After graduating from the Westinghouse students' course at Pittsburgh Mr. Van Vleet took up construction work and later acted as electrical engineer for a shipbuilding company. In 1903 he entered the employment of the Cutler-Hammer company at Pittsburgh and in the following year was made manager of the company's office at Chicago. Mr. Van Vleet has been active in the Electric Club of Chicago and has been one of the national officers of the Sons of Jove, acting as Mercury, or secretary, for the last two years. As an expression of the regard in which he is held by his Chicago associates a complete chafing-dish outfit of copper, handsomely mounted on a tray of Circassian walnut, was presented to Mr. Van Vleet.

MR. H. M. HOBART was the guest of honor on Jan. 21 at a dinner in London which was tendered by professional friends in view of Mr. Hobart's coming departure from Great Britain to join the engineering staff of the General Electric Company at Schenectady. Mr. H. F. Parshall presided and about a hundred of Mr. Hobart's friends were present. Mr. Hobart is a native-born American and upon graduation from the Massachusetts Institute of Technology joined the engineering staff of the Thomson-Houston Company, later remaining with the General Electric Company. In 1895 he went to Europe to join the British Thomson-Houston Company and was responsible for the electrical design of many important power-house and traction schemes. From 1900 to 1903 he was with the Union Elektricitäts Gesellschaft, Berlin, as chief designing engineer for direct-current machinery. Since 1903 he has practised as a consulting engineer in London and lectured on electrical engineering before some of the leading technical colleges. Mr. Hobart is the author of a number of works on electric machine designs, several of which have been translated into French and German.

Obituary.

MR. ALBERT WESTEEN, for ten years manager and superintendent of the Horton Water & Light Company, of Horton, Kan., died suddenly in Galesburg, Ill., his native city, on Jan. 21. Mr. Westeen was forty-nine years of age and leaves a widow. He was in Galesburg settling up his mother's estate when he was taken suddenly ill with an attack of heart disease, which resulted in his death. Mr. Westeen was highly regarded by the people of Horton and by his business associates. He was buried in Horton on Jan. 25.

Trade Publications.

PROJECTOR LAMPS.—The Universal Electric Stage Lighting Company, of New York, has issued a folder illustrating the various Kliegl lamps, pockets, plugs, etc., for stage work.

SWITCHBOARD METERS.—Machado & Roller, of New York, have issued an illustrated bulletin describing the shunted astatic switchboard type of Columbia meter made by the Columbia Meter Company, for which the concern acts as selling agent.

TESTING AND PRECISION APPARATUS.—The Leeds & Northrup Company, of Philadelphia, has issued a number of bulletins on its electric testing instruments. These include potentiometers, resistance pyrometers, thermocouple potentiometers and resistance standards.

GROUNDING DEVICE.—In a bulletin just issued by the Paragon Sellers Company, Chicago, Ill., are given some facts about grounding. The company manufactures the Paragon ground cone applicable for electric light, telegraph, telephone, trolley and railroad signal circuits, and the bulletin gives illustrations and methods of installing the cones for these various services.

ASH-HANDLING SYSTEM—Catalog No. 8 of the Green Engineering Company, Chicago, Ill., emphasizes the salient features of the company's pneumatic ash-handling systems. These are adaptable to almost any arrangement of building structures, and may be installed irrespective of the angles of direction or the difference of elevation between points of accumulation and final disposal of ashes.

TWELVE-HUNDRED VOLT RAILWAY.—The Washington, Baltimore & Annapolis Railway some time ago was converted from a 6600-volt, single-phase road to a 1200-volt, direct-current road, and an article descriptive of the system was published by Mr. J. R. Hewett in the *General Electric Review.* Bulletin No. 4808 of the General Electric Company is a reprint of the article in question.

TUNGSTEN FIXTURES.—Bulletin No. 8 of the Benjamin Electric Manufacturing Company, Chicago, Ill., contains a line of fixtures and accessories especially designed for the use of the tungsten lamp. Reflector sockets with both flat-cone and bowl-shaped reflectors, street-lighting fixtures for low-voltage and high-voltage circuits, and multiple and series sockets for large base lamps are featured.

ELECTRIC AUTOMOBILES.—The 1911 models of the Babcock electric carriages are shown in a catalog issued by the builder, Babcock Electric Carriage Company, Buffalo, N. Y., which has been manufacturing electrics for over twelve years. Eight models are illustrated and described, all of which are fitted with Philadelphia or Edison batteries. An exclusive feature of the vehicles is the foot control for stopping and for graduating the speed of the car.

BUSINESS NOTES.

THE POWER & MINING MACHINERY COMPANY moved its Chicago office to 825 Old Colony Building on Feb. 1.

THE MATSINGER DEVICE COMPANY, manufacturers of magnetos and other electrical appliances, has removed its factory and offices from Pendleton, Ind., to Lafayette, Ind.

THE CHICAGO ELECTRIC METER COMPANY, 400 South Hoyne Avenue, Chicago, manufacturer of printing attachments for meters, has

equipped its factory for the repairing and calibrating of meters of all kinds. The company has added to its force several meter experts and is well equipped for this class of work.

ENGINE LUBRICATION.—Three interesting bulletins, Nos. 01, 02 and 03, all of which treat of lubrication and especially of the White Star continuous oiling system, have been issued by the Pittsburgh Gage & Supply Company, Pittsburgh, Pa. The system is applicable to small as well as large engines, pumps, compressors, etc.

ELECTRIC FANS.—The Peerless Electric Company, Warren, Ohio, has issued its 1911 fan catalog, in which are described and illustrated ceiling, desk, bracket and oscillating fans for both direct-current and alternating-current circuits. The fans are of practically the same design as those of last year and embody only very slight changes in detail.

ELECTRIC FANS.—In Bulletin No. 5352 issued by the Western Electric Company are listed this year's models of "Hawthorn" fans. The line comprises the following types: Desk and bracket, oscillating, residence, telephone booth, battery, ceiling and column and ventilating outfits. The bulletin is contained within a stiff cover of bluish-gray, with an attractive cover design.

THE WELCHELL ELECTRIC COMPANY.—The plant of the Welchell Electric Company, of Anderson, Ind., has been purchased by F. R. Hoyt, of the Hoyt Electric Company, of Indianapolis, Ind., which manufactures a high-tension magnet for automobiles and also low-tension magnet for stationary engines. It is understood that the plant will be moved to Indianapolis, Ind.

ICE MACHINES FOR CENTRAL STATIONS.—The York Manufacturing Company, York, Pa., has recently sold ice-making auxiliaries to central-stations, as follows: Center Ice, Light & Power Company, Center, Texas (20-ton); Clarksville Light Co., Clarksville, Texas (10-ton); Grand Junction Electric & Ice Co., Grand Junction, Col. (25-ton); Electric Light & Power Co., Benton, Ark. (6-ton).

MEAD-MORRISON COAL-HANDLING INSTALLATIONS.—The Mead-Morrison Manufacturing Company has closed contracts with the Boston Elevated Railway for installing a complete new coal-unloading and storage plant for its new power house at South Boston, including unloading cars of the latest design, cable road and rehandling and pick-up bridge, and with the Edison Electric Illuminating Company of Boston for equipping its plant at South Boston with coal-handling machinery.

TRIUMPH ELECTRIC COMPANY, Cincinnati, Ohio, has recently opened a sales office at 728 Poydras Street, New Orleans. This is the sixteenth sales office now being maintained by this company and is the third to be opened during the past year. The Triumph Company in its new factory is turning out a large amount of work and anticipates even greater returns during the coming year. A large stock of standard machines will be carried at the New Orleans office for immediate shipment.

ELECTRIC HOME LAUNDRY MACHINES.—The Hurley Machine Company, of Chicago, has issued a booklet (No. 50) devoted to the Thor electric washing and wringing machine. A series of pictures is given to show how this machine robs washday of its terrors. It is said that by its use a whole week's washing for a family of six may be accomplished in ninety minutes. Three sizes of the machine are illustrated. The motors are large enough to operate the washing machine and wringer at the same time.

ELEVATOR CONTROLLERS.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued a booklet describing the line of electric elevator controllers developed by the J. L. Schureman Company, of Chicago, Ill., and which are now built by the Cutler-Hammer Manufacturing Company. The controllers are applicable for direct-current and alternating-current circuits, and the particular types best suited for certain specified classes of service are pointed out. Outfits for passenger, freight and dumbwaiter service are described, as well as the accessories and various methods of control.

THE MORRIS IRON COMPANY.—The Morris Iron Company, of Frederick, Md., will take over the business of the Elmer P. Morris Company, Frederick Iron Works, Frederick, Md., and the Montrose Iron Works. These companies have been large manufacturers of iron goods, making a specialty of outdoor lighting fixtures and material. Mr. Elmer P. Morris becomes the manager and vice-president of the company. The present facilities will be greatly enlarged and the general policy continued. Stocks will be carried at the factory and at the warehouse in New York. The sales office is located at 88 West Street, New York City.

CEMENT PLANT ELECTRICAL EQUIPMENT.—The Michigan Cement Company has ordered a complete electrical equipment from the General Electric Company for its cement plant now in course of construction at Chelsea, Mich. At first only part of the electric power will be generated for the operation with two three-phase generators with exciters, one of 200 and the other of 150-kw capacity, the deficiency of power to be purchased. Thirty-five induction motors, aggregating 1133 hp capacity, have been ordered for driving the various machines. The switchboard for controlling the output of the two generators and the power company's service transformers will consist of seven panels, two three-phase, 60-cycle generator and exciter panels, four power feeder panels and one lighting and power feeder panel. A 30-kw transformer, which will carry a lighting load, is included in the order.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

Alabama Light & Traction Association. Secretary, Geo. S. Emery, 11 N. Royal St., Mobile, Ala.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Next semi-annual meeting, New York City, April or May, 1911.

American Electro-Therapeutic Association. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York. Next meeting at Philadelphia, Pa., Sept. 5, 6 and 7, 1911.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, Engineering Societies Building, 33 West 39th St., New York. Meetings, second Friday of each month, excepting June, July, August and September.

American Electric Railway Accountants' Association. Secretary, H. E. Weeks, Davenport, Ia.

American Electric Railway Engineering Association. Secretary, Norman Litchfield, Interborough Rapid Transit Company, New York.

American Electric Railway Association. Secretary, H. C. Donecker, Engineering Societies Building, 29 West 39th St., New York.

Arkansas Association of Public Utility Operators. Secretary, J. E. Cowles, Little Rock, Ark.

Association of Iron and Steel Electrical Engineers. Secretary, James Farrington, Steubenville, O.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, 135 Adams St., Chicago. Next meeting, Boston, Mass., June, 1911.

Association of Railway Electrical Engineers. Secretary, J. Andreucetti, Chicago & Northwestern Railway, Chicago. Next annual meeting, Chicago, November, 1911. Semi-annual meeting, Washington, 1911.

Association of Edison Illuminating Companies. Secretary, N. T. Wilcox, Lowell, Mass.

Canadian Electrical Association. Secretary, T. S. Young, 220 King St. West, Toronto, Can.

Canadian Street Railway Association. Secretary, Allen H. Royce, 48 King St. West, Toronto, Ont.

Central Electric Railway Association. Secretary, A. L. Neereamer, Indianapolis, Ind.

Colorado Electric Light Power & Railway Association. Acting Secretary, F. D. Morris, 323 Hagerman Building, Colorado Springs, Col.

Eastern States Independent Telephone Association of Pennsylvania, New Jersey, Maryland and Delaware. Secretary, H. E. Bradley, 135 South Second St., Philadelphia, Pa.

Electric Vehicle Association of America. Secretary, Harvey Robinson, 124 West 42d St., New York.

Electric Club, Chicago. Secretary, F. S. Hickok, 824 Marquette Building, Chicago. Meets every Wednesday noon, 303 Wabash Ave.

Electrical Contractors' Association of New York State. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

Electric Trades Association of Philadelphia. Secretary, J. W. Crum, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursday of each month.

Electrical Contractors' Association of State of Missouri. Secretary, Ernest S. Cowie, 1413 Grand Ave., Kansas City, Mo.

Electrical Salesmen's Association. Secretary, Francis Raymond, 125 Michigan Ave., Chicago. Annual meeting, Chicago, January, each year.

Electrical Trades Association of Canada. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Can.

Electrical Credit Association of Chicago. Secretary, Frederic P. Vose, Marquette Building, Chicago.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meeting, San Francisco, second Thursday of each month.

Electrical Trades Society of New York (Member National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of directors meets second Thursday of each month.

Empire State Gas & Electric Association. Secretary, Charles H. B. Chapin, Engineering Societies Building, 29 West 39th St., New York.

Engine Builders' Association of the United States. Secretary, C. H. Lembower, Reading, Pa.

Florida Electric Light & Power Association. Secretary, H. C. Adams, West Palm Beach, Fla. Next meeting, Jacksonville, Fla., April 4 and 5, 1911.

Illinois State Electrical Association. Secretary, H. E. Chubbuck, Peoria, Ill.

Illuminating Engineering Society. Secretary, P. S. Millar, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago. Annual convention, Chicago, 1911.

Independent Electrical Contractors' Association of Greater New York. Secretary, L. H. Woods, 2355 Jerome Ave., New York.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, J. V. Zartman, Indianapolis, Ind.

INTERNAL COMBUSTION ENGINE ASSOCIATION. Secretary, Chas. Kratch, 416 W. Indiana St., Chicago. Meetings, second Friday of each month.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Next meeting, St. Paul, Minn., 1911.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster. London, S. W., England.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Dubuque, Ia. Next meeting, Davenport, Ia., April 19, 20 and 21, 1911.

IOWA STREET & INTERURBAN ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Ia. Next meeting, Davenport, Ia., April, 1911.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Independence, Kan., Sept. 21 and 22, 1911.

MAINE ELECTRICAL ASSOCIATION. Secretary, Walter S. Hyman, Waterville, Maine.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

MICHIGAN ELECTRIC ASSOCIATION. Secretary, Herbert Silvester, Detroit, Mich.

MINNNESOTA ELECTRICAL ASSOCIATION. Secretary, T. C. Gordon, Little Falls, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Secretary, A. H. Jones, McComb City Light and Power Co., McComb City, Miss.

MISSOURI ELECTRIC, GAS, STREET RAILWAY & WATER ASSOCIATION. Secretary, N. J. Cunningham. Next meeting, St. Louis, April, 1911.

NATIONAL ARM, PIT & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEW ENGLAND SECTION. Secretary-Treasurer, L. D. Gibbs, 39 Boylston Street, Boston, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION, PENNSYLVANIA SECTION. Secretary-Treasurer, Van Dusen Rickert, Pottsville, Pa.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEBRASKA SECTION. Secretary-Treasurer, S. J. Bell, David City, Neb.

NATIONAL ELECTRIC LIGHT ASSOCIATION, GEORGIA SECTION. Secretary-Treasurer, H. M. Corse, Columbus Railroad Company, Columbus, Ga.

NATIONAL ELECTRIC CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y. Next meeting, Niagara Falls, July 19, 1911.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive Secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York.

NATIONAL ELECTRICAL INSPECTORS' ASSOCIATION. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn. Next meeting, New York, March, 1911.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 343 Marquette Bldg., Chicago.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. C. Davis.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, Frank McMaster, Beatrice, Neb.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, I. G. Marks, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesdays of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL & STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio. Next meeting at Youngstown, May 18 and 19, 1911.

OKLAHOMA PUBLIC UTILITIES ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla.

ORDER OF REJUVENATED SONS OF JOVE. Mercury (Secretary), R. M. Van Vleet, 1157 Monadnock Building, Chicago, Ill.

PACIFIC COAST ELECTRIC VEHICLE ASSOCIATION. Secretary, A. H. Halloran, 604 Mission St., San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary-Treasurer, Van Dusen Rickert, Pottsville, Pa.

PENNSYLVANIA STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings, second Saturday of each month.

PITTSBURG ELECTRIC BOOSTER CLUB. Recording Wattmeter, O. R. Rombach, 919 Liberty Ave., Pittsburg, Pa. Meetings, fourth Monday of each month.

RAILWAY ELECTRIC SUPPLY MANUFACTURERS' ASSOCIATION. President, A. C. Moore, Safety Car Heating & Lighting Co., Chicago.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, H. H. Norris, Cornell University, Ithaca, N. Y.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, E. D. Forbes, Box 63, Brant Rock, Mass. Monthly meeting, first Monday of each month.

SOUTHWEST ELECTRIC & GAS ASSOCIATION. Secretary, E. T. Moore, Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, C. G. Reel, Kingston, N. Y.

UNDERWRITERS' NATIONAL ELECTRICAL ASSOCIATION. Secretary Electrical committee, C. M. Goddard, 141 Milk St., Boston, Mass. Next biennial meeting, March, 1911.

VERMONT ELECTRICAL ASSOCIATION. Secretary, A. B. Marsden, Manchester Center, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 145 Monroe St., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1, each year.

WIRELESS INSTITUTE. Secretary, Alfred N. Goldsmith, College of the City of New York, New York.

WISCONSIN ELECTRICAL ASSOCIATION. A consolidation of the Northwestern Electrical Association and the Wisconsin Electric and Interurban Railway Association. Secretary, John S. Allen, Lake Geneva, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JAN. 24, 1911.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

982,248. FLEXIBLE CONDUIT; A. E. Chernack, Boston, Mass. App. filed Dec. 20, 1909. Avoids buckling the tube by having inner and outer tubular layers of woven fabric and two intermediate layers of paper, coiled spirally with waterproof composition.

982,253. OIL-SWITCH; S. B. Condit, Jr., Boston, Mass. App. filed March 16, 1909. An oil pan with hinged cover carrying a switch below the cover with operating mechanism for the switch on the upper side of the cover.

982,266. IMPEDANCE DEVICE; W. R. Garton, Chicago, Ill. App. filed Nov. 11, 1907. A coil of insulated wire of high impedance with a sheet surrounding it of metal such as iron and an electrically-grounded terminal, grounded through a lightning arrester, alongside of the coil.

982,274. PRINTING TELEGRAPH; C. K. Jones, Kansas City, Mo. App. filed Sept. 2, 1909. Selecting relays so that the operation of a single relay in the main line circuit controls the selective action of the selective relays and any one of a plurality of type bars. Three groups of operating magnets for printing lower case, upper case, and the third group for operating the keyboard of a typesetter.

982,275. PRINTING TELEGRAPH; C. K. Jones, Kansas City, Mo. App. filed Sept. 14, 1909. Provides three sets of printing and operating magnets controlled by circuit-making relays which may be increased or diminished in number with a transmitter, a receiver, selecting relays which select the particular magnet corresponding to the letter or signal and means controlled by a single line circuit for controlling the circuit-forming relays.

982,276. PRINTING TELEGRAPH; C. K. Jones, Kansas City, Mo. App. filed Jan. 17, 1910. Electrically controlled selecting relays, primary selecting relays, secondary selecting circuits with relays in clusters, the relays in each cluster succeeding the first connected relay for simultaneous operation, each secondary relay but the last controlling the circuits through the contacts of a plurality of relays of the next cluster, printing magnets connected to the secondary relays, a retarding set of relays, the final relay of which set is operated by long pulses, a restoring circuit operated by the final relay passing through the selecting relay and primary relays.

982,281. HIGH-TENSION CURRENT PROTECTION; C. J. Lincoln and E. E. Weil, New Orleans, La. App. filed July 8, 1908. A spark gap having knife edges and needle points near the edges separated by an air gap.

982,284. SAFETY DYNAMIC BRAKING SYSTEM FOR HOISTS; J. S. McKee, Pittsburg, Pa., and J. F. Schnabel, New York, N. Y. App. filed Jan. 8, 1909. A motor with two dynamic breaking circuits, including the armature and field, a switch for each circuit and means whereby one switch controls the other so that when one is closed the other is open.

982,288. PREPARATION OF NITROGEN COMPOUNDS; E. H. Meyer, Niagara Falls, and J. M. A. Stillesen, Centre, Canada. App. filed Sept. 15, 1908. Prepares lime nitrogen by treating calcium carbid with nitrogen and eliminating carbon from the resulting product by oxidation with carbon dioxide.

982,331. THERMOSTATIC DAMPER CONTROLLING APPARATUS; B. C. Wickes, Auburn, N. Y. App. filed March 27, 1908. A damper regulator with damper actuating mechanism, a spring motor operating it and a thermostat and electric connections for actuating the dampers with a safety cut-out switch for causing the dampers to be moved into open draft position.

982,345. CANOPY SWITCH; R. B. Benjamin, Chicago, Ill. App. filed Dec. 28, 1907. Rotary make and break switch operated by a pull cord, for connecting one or more lights in circuit arranged in a canopy to be attached to the ceiling.

982,346. ELECTRICALLY-OPERATED AUTOMATIC CUT-OFF; P. A. Brown, Denver, Colo. App. filed Dec. 20, 1909. An automatic cut-out with slide bar, circuit closer and wires with a pair of magnets, an armature actuated by the magnets and a non-conducting link connecting the armature with the slide bar, contacts in circuit with the magnets actuated by the slide bar and contacts actuated by the circuit-closer, with means for preventing the recoil of the armature.

982,352. ELECTRIC SIGN; A. V. Diehl, Englewood, N. J. App. filed Dec. 31, 1909. An electric sign with a base, two parallel strips, a letter block between the strips with resilient contacts and a combined contact and catch for resiliently engaging one of the contact members on one of said strips.

982,362. MOTOR CONTROLLER; C. T. Henderson, Milwaukee, Wis. App. filed May 14, 1910. For motor-operated skip hoists, with means for starting and stopping the motor and automatically-operated means controlling the former to cause the motor to start after the load reaches a certain weight and to stop when the load has reached a certain position.

982,365. MOTOR CONTROLLING DEVICE; A. J. Horton, White Plains, N. Y. App. filed June 1, 1909. A motor controlling device with a pivoted resistance element, a longitudinally movable operating member and a switch member resiliently mounted upon the operating member, the latter moving the pivoted resistance element after the switch has engaged its contacts.

982,377. DYNAMO ELECTRIC MACHINE FOR MAINTAINING A CONSTANT ELECTROMOTIVE FORCE UNDER VARIATIONS OF SPEED; M. M. W. Mackie, Ealing, England. App. filed Aug. 24, 1906. An electric supply system with work circuit and multipolar dynamo with magnetizing winding on all of its poles, a demagnetizing winding on some poles in parallel, a storage battery supplying the work circuit in opposition to the dynamo through the demagnetizing winding, the arrangement allowing only a small current to flow when the normal voltage of the dynamo obtains and a regulating current to flow when the speed exceeds normal.

982,407. ELECTRODE FOR FLAMING ARC LAMPS; M. W. Allen, and W. T. Conn, Lakewood, Ohio. App. filed April 23, 1909. Has a wire extending through the electrode from end to end and projecting from the top, the projecting end being mechanically and electrically connected to the electrode, embedded in metal.

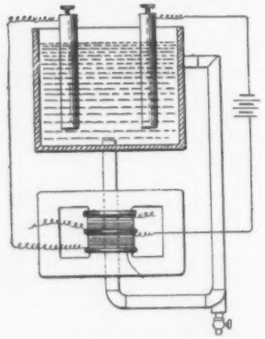
982,420. ELECTRIC FURNACE; C. F. J. Forssell, Cleveland, O. App. filed July 20, 1908. An electric furnace with a resistance between the terminals, consisting of resistor tubes fitting into water-cooled terminals provided with slots for charging them, the tubes having carbon walls, thus generating heat necessary to maintain a temperature in a zone adjacent to the wall as high as that of the wall itself.

982,450. TELEPHONIC INSTRUMENT; S. L. Van Akin, Jr. App. filed March 10, 1908. Telephone with hollow arms hinged together, one arm carrying a transmitter near the junction, a receiver also secured to one of the arms and circuit connections passing through the arms and connected to the receiver and transmitter.

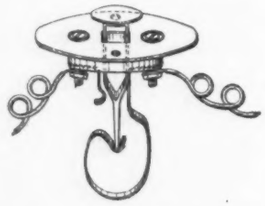
982,462. ELECTRIC INCUBATOR AND NURSERY; A. Beckstrom, Lewistown, Mont. App. filed March 11, 1909. Incubator and nursery in which the eggs are turned by a traveling belt and a thermostat controls an electric heater which heats the incubator.

982,470. ELECTRIC LAMP; J. O. Camp, Jr., Jacksonville, Ala. App. filed July 26, 1910. Incandescent electric lamp with filaments of different candle powers, a base for the lamp with separate circuit terminals for one end of each filament, another base into which the first base telescopes, the second base adapted to a lamp socket and a rack and pinion separating the bases so as to throw in the filaments successively.

982,493. ELECTROLYTIC CELL; A. S. Hickley, Manasquan, N. J. App. filed Nov. 25, 1907. An electrolytic cell with a transformer whose waste heat warms the cell.



982,493.—Electrolytic Cell.



982,544.—Electrical Floor or Wall Connector.

982,494. ELECTROLYTIC ALTERNATING CURRENT RECTIFIER; A. S. Hickley, Manasquan, N. J. App. filed June 26, 1908. Electrolytic elements in opposition with a circuit provided with translating devices bridging elements of like polarity for electrolytic-alternating current rectifiers whereby the hydroxid of aluminium is always ready formed and the cell ready to work.

982,503. INCUBATOR ALARM; W. M. Kelly, Herkimer, N. Y. App. filed July 1, 1909. Gives an audible alarm through a thermostat and electric circuit when the temperature rises or falls above a predetermined point.

982,519. AUTOMATIC SAFETY DEVICE FOR ELEVATORS; H. P. May, Kansas City, Mo. App. filed Dec. 26, 1908. Electrically-controlled means whereby the opening of the doors at each landing of the elevator throws in a brake for the operating motor to lock it and prevents movement of the car until the door has been closed.

982,535. OUTLET BOX; C. Rudkiewicz, Detroit, Mich. App. filed Aug. 8, 1910. Has a wall with a circular opening and laterally-extending notches, a tubular socket with a pipe at its outer end and a reduced inner end to fit the opening and a shoulder to engage the outer face of the wall with outward spaced lugs and a member on the inner side of the wall of the box to engage one of the lugs and preventing the turning of the socket member.

982,544. ELECTRICAL FLOOR OR WALL CONNECTOR; S. E. Steele, Pittsburg, Pa. App. filed March 2, 1910. For the floors of dining-rooms and the like, with a special socket to receive the plug having spring contacts, one end having a V-shaped seat to support the plug.

982,546. LOCK-OUT PARTY LINE TELEPHONE SYSTEM; A. Swenson, Willmar, Minn. App. filed March 22, 1907. Party line with individual calls and lock-out so as to lock out the third telephone and prevent listening in, by means of a switch-lever and electromagnet for locking it and a centrifugally-actuated circuit-closer actuated by the magneto.

982,549. ROTARY SNAP SWITCH; G. B. Thomas, Bridgeport, Conn. App. filed Aug. 14, 1908. Has a base and stops with an operating spindle carrying a crank arm, a latch-bar pivoted to the arm engaging the stops, a switch-plate with which the latch-bar is in sliding engagement and a tension and spring between the spindle and the plate.

982,551. EXCESSIVE ELECTRICAL CURRENT-ARRESTER; M. E. Vaughn, Plainfield, Ind. App. filed Aug. 9, 1909. A main conducting wire with a carbon block on each side, insulation between the blocks and wire so as to space the blocks from the wire, means for clamping the blocks and insulation to the wire and a ground wire running from one of the carbon blocks to the ground.

982,552. X-RAY TUBE; H. F. Waite, New York, N. Y. App. filed Jan. 25, 1906. An X-ray apparatus with a bulb provided with a target, a pair of electrodes and a screen between one of the electrodes and the target.

982,557. REINFORCED GRID RESISTANCE; H. J. Wiegand, Milwaukee, Wis. App. filed May 4, 1908. A grid having U-shaped reinforcing strips placed over the edges of the grid and transversely-extending ribs formed thereon.

982,563. TERMINAL OR LUG FOR ELECTRICAL CONDUCTORS; C. R. Baird, New York, N. Y. App. filed March 19, 1910. A lug to be detachably secured to a stranded conductor, including a tubular clamping member, threaded on the outside to engage a threaded sleeve which compresses the strands between the ends of the member and the socket carrying a conical boss on the inside of the sleeve.

982,576. BATTERY; H. W. Darby, Winnipeg, Manitoba, Canada. App. filed March 31, 1910. Primary battery with a U-shaped zinc electrode dipping into mercury, a carbon electrode which is porous and contains one of the electrolytes and an open ended porous insulator between the electrodes.

982,587. APPARATUS FOR PRODUCING AND UTILIZING ELECTRICAL EFFLUVIA. L. Gerard, Brussels, Belgium. App. filed Aug. 1, 1907. For making ozone by means of smooth surface metallic electrodes in contact with the outer surfaces of dielectric walls, a gas passage conveying the gas in contact with one of the electrodes on its way to the gap and a liquid insulator and cooling medium in contact with the other electrode.

982,638. TELEGRAPHIC DOT TRANSMITTER; H. H. Smith, Brooklyn, N. Y. App. filed June 22, 1910. A transmitter key with a supplemental lever pivoted on the main lever of the key and a vertical vibratory lever extending from the supplemental lever to open and close the electric circuit of the apparatus at definite intervals.

982,641. TELEPHONE MOUTHPIECE; L. Steinberger, New York, N. Y. App. filed June 20, 1910. Has an outer flange surrounding the rim for carrying a plate for bearing names and telephone numbers.

982,659. SYSTEM OF TELEGRAPHY; R. L. Dean, Kansas City, Mo. App. filed Feb. 1, 1908. A carriage with two electromagnets, two armature levers actuated thereby, a character on one of the levers for printing certain letters of the alphabet, a portion of the remaining letters of the alphabet and a character on the other lever for printing the remainder of the incompleted letters.

982,693. INCANDESCENT LAMP SOCKET; F. E. Seeley, Bridgeport, Conn. App. filed May 25, 1908. A pull socket with switch spindle and ratchet spring, with an adjustable abutment for the spring having a flanged socket forming an end bearing for the spindle, the flange being perforated to receive one end of the spring and notched to receive the detaining member.

982,695. INDUCTIVE MOTOR CONTROL; A. Sundh, Yonkers, N. Y. App. filed June 27, 1907. An inductance coil with a fixed contact in the circuit of the coil, a lever carrying a contact movable into engagement with the fixed contact to complete the circuit through the coil, a movable core for the coil and an extension carried by the core in the path of movement of the lever.

982,704. METHOD OF PURIFYING WATER; W. B. Bull, Chicago, Ill. App. filed May 31, 1910. Treats the water with a coagulating material by producing through electrolysis a solution which is a solvent of iron, forming an iron compound in a separate chamber, precipitating so as to form a coagulant and then coagulating the impurities thereby.

982,705. APPARATUS FOR PURIFYING WATER; W. B. Bull, Chicago, Ill. App. filed June 6, 1910. Apparatus for process of 982,704, with an electrolytic apparatus for producing a solution containing a solvent of iron and an alkali, a receptacle separate from the anode chamber containing a suitable metal through which the iron solvent is passed, a receptacle for the water to be purified, the metal receptacle discharging into the water receptacle.

982,729. POROUS CUP ELECTRODE; P. J. Kamperdyk, New York, N. Y. App. filed Nov. 9, 1907. For two fluid cells, the separating wall consisting wholly of graphite in the form of a hollow cup whose walls are of sinuous form or provided with ribs.

982,735. ELECTRICAL RESISTANCE; J. F. McElroy, Albany, N. Y. App. filed May 18, 1910. Includes a fine wire combined with a moisture-proof cord of refractory insulation, on which the wire is wound and an insulated support on which the cord is mounted.

982,738. INCLOSED FUSE; C. R. Moellendorf, Seattle, Wash. App. filed July 18, 1910. Complimentary shells with caps, the former insulating and the latter conducting, with a fusible element and tongues extending from the caps and means for detachably connecting the fusible element to the tongues, a strip detachably connecting the tongues.

982,751. GLOWER FOR ELECTRICAL INCANDESCENT LAMPS; O. M. Thowless, Newark, N. J. App. filed May 1, 1908. Composed of tungsten and a refractory oxide covered with refractory metal.

982,764. ELECTRIC CONDUCTOR MOLDING; S. M. Burk, Philadelphia, Pa. App. filed Dec. 9, 1907. Has a channel to receive the conductor and grooved at intervals adjacent to the channel, making the walls springy so that the conductor can be forced into the channel.